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TRW Systems Group, Redondo Beach, Calif

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The Implementation Planning Program is a group of computer simulation models designed to assist the air quality control regions in developing meaningful air pollution control strategies. Through application of simulation techniques, the Program is used in selecting appropriate emission standards, evaluating the resulting air quality, and determining the costs associated with the various alternative control strategies. There are certain operational restrictions. The control regulations, or emission standards, are restricted to stationary sources of pollution, although the program accounts for the effects of control regulations on mobile emissions. At present the computer simulation takes into consideration only two pollutants, sulfur oxides and suspended particulate matter.

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AIR QUALITY IMPLEMENTATION PLANNING PROGRAM

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PREFACE

In developing the Air Quality Implementation Planning Program described in this manual, TRW Systems Group has been guided by the intent of the Clean Air Act as amended, as well as by extensive direct communication with National Air Pollution Control Administration personnel.

We are particularly indebted to Robert M. Jimeson of the Office of Program Development for overall guidance in this project. Special acknowledgement is also due to Jack R. Farmer, Philip Bierbaum, Jr., Jerome B. Mersch, and Joseph A. Tikvart of the Division of Abatement, and to D. Bruce Turner of the Division of Meteorology. The advice and assistance offered by these personnel have been essential to the development of an effective program.

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1.0 INTRODUCTION

The Clean Air Act, as amended (42 U.S.C. 1857 et seg.), provides for an inter-governmental system for the prevention and control of air pollution on a regional basis. To put this system into operation, the Department of Health, Education, and Welfare must designate air quality control regions and issue air quality criteria and reports on control techniques. State governments are then expected to establish air quality standards for the air quality control regions and to adopt plans for implementation of the standards. The air quality standards and implementation plans must be submitted to the Department for review.

An implementation plan is a blueprint of the steps that will be taken to insure attainment of air quality standards within a reasonable time. It includes all the steps to be taken to abate and control pollutant emissions from existing sources in an air quality control region and to prevent urban and economic growth from adding to a region's air pollution problem. An implementation plan should include at least the following major elements: (1) emission control regulations for each pollutant, (2) time schedule for achieving compliance, (3) emergency action procedures, (4) surveillance programs for air quality and emissions, (5) definition of required legal authority, and (6) determination of required resources.

The heart of the implementation plan is its emission control regulations, which set forth requirements for prevention, abatement, and control of a given type of air pollution and establish a timetable for obtaining compliance with those requirements. The emission control regulations should be the product of a comprehensive assessment of the nature and extent of the pollution in the region involved, including a review of existing pollution levels, types of source and their emissions, available control techniques, and probable increase in source emissions due to urban and economic growth. Based on this assessment, various emission control strategies can be formulated. These strategies should then be tested, with the aid of a systematic quantitative procedure, to determine which if any are capable of bringing about attainment of the air quality standards. This manual describes such a systematic procedure for evaluating emission control strategies.

The Implementation Planning Program (IPP) contains a set of models designed for use in the evaluation of alternative emission control strategies. These models are (1) an Atmospheric Diffusion Model, (2) a Control Model, (3) a Control Strategies Model, and (4) an Information System. The program requires a detailed regional emission inventory and a description of the meteorological data (wind speed, wind direction, mixing depth, and stability class) for the region. Air quality data are also needed to validate the diffusion model predictions. After the necessary data have been obtained and the diffusion model validated, the user can then select several alternate emission control strategies which he wishes to evaluate. The control strategy model determines the allowable emissions for each point source with each strategy. For each such source, the cost-effectiveness model selects the least expensive control measure available to each source to meet its allowable emissions. The diffusion model uses the allowable emissions data to determine the resulting air quality throughout the region. The computer-processed output shows the resulting air quality at several receptor sites throughout the region for each control strategy. The program provides a list of locations at which the desired air quality standards are exceeded, as well as pollutant contributions at specific locations from each source within the region. The allowable emissions and total point-source cost of compliance for each strategy are also presented.

The Implementation Planning Program has been designed as a part of a more comprehensive Regional Air Pollution Analysis (RAPA). In addition to the models in the Implementation Planning Program, the Regional Air Pollution Analysis will include an econometric and benefits model which provide a means for assessing the benefits of air pollution control (or, conversely, the damages caused by air pollution) and the far-reaching regional economic effects of air pollution control costs.

The Air Quality Display Model (AQDM), issued in February 1970, is the Atmospheric Diffusion Model portion of the Implementation Planning Program and Regional Air Pollution Analysis. AQDM was designed to estimate the spatial distribution of air quality levels in a region on the basis of an emission inventory and meteorological data. These air quality levels could then be compared to air quality criteria to determine the seriousness of the air pollution problem. AQDM was primarily intended for use by the States in setting air quality standards.

2.0 IMPLEMENTATION PLANNING PROCESS

A document entitled Guidelines for the Development of Air Quality Standards and Implementation Plans has been issued by the Department of Health, Education, and Welfare to assist State governments in developing air quality standards and implementation plans that can be considered consistent with the provisions and intent of the Air Quality Act as amended. This document provides a detailed description of the implementation planning process (Sections 1.52 and 2.30 through 2.34). The implementation planning process is designed to meet one of the most important objectives of the Act -- to ensure that air pollution will, in the future, be controlled in a logical and systematic way.

Each implementation plan and the provisions for carrying it out must be described in detail when the plan is submitted for review by the Department of Health, Education, and Welfare. This description must cover all projected requirements for the prevention and control of air pollution, the timetable for placing those requirements into effect, and provisions for surveillance, legal authority, etc. It must also include an explanation of the basis upon which the implementation plan was developed. Finally, it must include a description of the resources, funds, manpower, and equipment that will be needed to carry out the plan, as well as information on the extent to which those resources already exist and plans for filling any gaps. The following Sections provide a discussion of each of the major elements that must be included in an implementation plan.

2.1 EMISSION CONTROL REGULATIONS

The heart of an implementation plan is its emission control strategy, which sets forth requirements for the prevention, abatement, and control of a given type of air pollutant and establishes a timetable for obtaining compliance with those requirements. Legally enforceable emission standards applicable to sources of the pollutant will ordinarily be a principal element of the emission control strategy. The strategy may also include regulations pertaining to such factors as fuel use, location of new industrial plants and other potential pollutant sources, open burning, and disposal of solid waste materials.

The emission control strategy for a specific type of air pollution should be the product of a comprehensive assessment of the nature and extent of pollution in the given region. A review should be made of pollution levels, types of sources and emissions, available control techniques, and probable increase in source emissions due to urban and economic growth. Various emission control strategies can be formulated on the basis of this assessment and tested, preferably through a systematic, quantitative procedure, to determine whether or not their application will result in attainment of the air quality standards.

2.2 TIME SCHEDULE

Scheduling of the steps specified in an implementation plan should be designed to ensure prompt and orderly progress toward the air quality standard. Emphasis should be placed on the earliest possible application of existing control techniques as well as the adoption of new techniques as they become available. Careful consideration should also be given to time-phasing of control measures. The air quality standard for sulfur dioxide, for example, might specify interim switching to low-sulfur fuels for some sources in order to provide sufficient time for installation of suitable control systems. Various combinations of control measures should be considered when the emission reduction timetable is being prepared.

2.3 EMERGENCY ACTION PROCEDURES

Attainment of the desired long-term average concentration levels for a given pollutant will require orderly application of control techniques over a period of months or years. As progress is made toward the long-term goals, the likelihood that short-term pollutant concentrations will exceed the applicable standard should steadily diminish. States must nonetheless be prepared to take steps to prevent the occurrence of episodes in which pollutant concentrations may exceed the applicable short-term air quality standard, particularly in cases where the standard is based exclusively or primarily on health considerations. During periods of atmospheric stagnation, extensive short-term control action may be required. Plans for averting or alleviating such episodes should incorporate (1) an adequate surveillance system to detect the problem at the earliest possible time and (2) a series of planned control steps designed to bring about an immediate reduction of pollutant emissions on an interim basis.

2.4 SURVEILLANCE

Every implementation plan must include provisions for surveillance of air quality and source emissions. The implementation plan will specify various abatement and control measures designed to bring about attainment of air quality standard, and surveillance of source emissions will provide assurance that these measures are being taken. Surveillance of air quality, through effective air monitoring and data analysis, is thus the means by which the impact of control measures is gauged. If surveillance data indicate that the desired progress is not being made, appropriate adjustments to the implementation plan will be required.

2.5 LEGAL AUTHORITY

Every implementation plan must include provisions for enforcement by State action, even though the State elects to delegate some or all of this responsibility to local and regional agencies.

Adequate legal authority will generally include the power to: adopt and enforce standards and regulations pertaining to air pollution sources and emissions; enter and inspect facilities that are contributing to, or may contribute to, air pollution; gather and evaluate data on ambient air quality and pollutant emissions; hold public hearings on matters such as rule-making and enforcement; issue orders to enjoin violations of standards and regulations; impose penalties; grant variances; require reporting of information on air pollution sources and emissions and on activities that contribute to, or may contribute to, air pollution; conduct necessary studies and investigations; require that plans for new facilities that may contribute to air pollution be submitted for review prior to their construction; develop and distribute information to the public; and take action to deal with air pollution episodes.

2.6 DETERMINATION OF REQUIRED RESOURCES

In addition to the planning elements described above, each air quality control region is expected to submit recommendations concerning required resources. Such resources include the local and Federal grants necessary to carry out the plan. The determination of resources must provide sufficient detail to identify funds required for such items as permit inspection personnel and equipment, e.g., pollutant sensors and telemetry communications facilities.

3.0 IMPLEMENTATION PLANNING PROGRAM SUMMARY

3.1 SCOPE OF PROGRAM

The Implementation Planning Program is a group of computer simulation models designed to assist the air quality control regions in developing meaningful air pollution control strategies. The regional air quality implementation process discussed in Chapter 2 is based on the application of a set of stationary source emission controls in the form of emission standards. The many combinations of these standards result in a variety of alternative control strategies. Through application of computer simulation techniques, the Implementation Planning Program is used in selecting appropriate emission standards, evaluating the resulting air quality, and determining the costs associated with the various alternative control strategies. there are

The Implementation Planning Program is a computer simulation designed for operation on an IBM 360 computer facility. At present the smallest computer configuration required to operate the program is the IBM 360/40 system. Larger facilities (such as the 360/50 or 360/65) with appropriate peripheral equipment are compatible with the program design. A more detailed specification of the computer system and the peripheral equipment is provided in the installation test procedures, Chapter 10.

The applicability of the Implementation Planning Program is bounded by certain operational restrictions. The control regulations, or emission standards, evaluated by the program are restricted to stationary sources of without pollution, The program accounts for the effects of control regulations on mobile emissions by including both existing and future mobile source contributions to the total area source inventory of pollutant emissions.

At present the computer simulation takes into consideration only two pollutants, sulfur oxides and suspended particulate matter.* This restriction stems from the fact that the Department of Health, Education and Welfare has to date published air quality criteria and control techniques documents for only these pollutants. As criteria and control technique information are published for additional pollutants, the Implementation Planning Program will be modified accordingly.

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*Input information on CO emissions from stationary sources is also described in this manual, in anticipation of expansion of the program to include this pollutant.

Although certain data on air quality, meteorological conditions, and other parameters are expressed in short time spans (days or months), the computer simulation is concerned primarily with an annual time scale. The short-term parameters are included for future application in more critical analyses. Use of short-term data in the Implementation Planning Program is restricted because of the use of both a long-term atmospheric diffusion model and emission standards that require the application of continuous and permanent control measures. Future modifications will expand the application of the program to short-term air pollution control consistent with short-term air quality criteria.

The selection and evaluation of emission standards in a control strategy is restricted to the political jurisdiction within an air quality control region. Pollutants from man-made sources outside this region and natural ground-level background concentration are uniformly distributed and unaffected by meteorological conditions or emission standards. When a sufficient number of regions use this type of simulation technique, it will be possible to analyze the effects of control strategies in one region on the air quality in a neighboring region.

The accuracy with which the computer simulation models predict air quality conditions and control costs is dependent on the quality of input information. Certain minimum data requirements are expressed in the detailed description of the models, but as in most computer simulations of the real world, better input information results in better output results.

3.2 COMPUTER SIMULATION MODELING

Before delving into a design summary and detailed structure of the models contained in the Implementation Planning Program, the user is encouraged to review a few general observations on computer simulation modeling.

The concept of computer simulation modeling, shown in Figure 3-1, is based on the use of mathematical models.

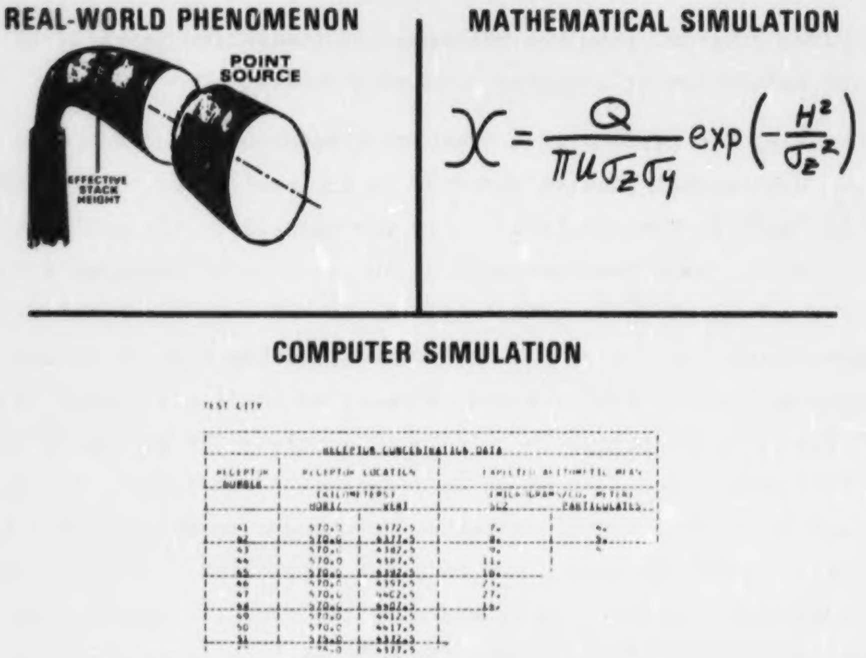
REAL-WORLD PHENOMENON
POINT SOURCE
EFFECTIVE STACK HEIGHT
MATHEMATICAL SIMULATION
$\chi = \frac{Q}{\pi u \sigma_z \sigma_y} \exp\left(-\frac{H^2}{\sigma_z^2}\right)$
COMPUTER SIMULATION

Figure 3-1 Computer Simulation Modeling

A mathematical model is one or more equations or inequalities which translate a real-world system into a numerical and relational form. In the case of air pollution control, the real-world system includes such aspects as pollution sources, atmospheric processes, receptors, and pollution control techniques. All of these items are elements in a system. The mathematical models describe the relevant features of each element, as well as the relationships between elements. For example, equations are provided for the characteristics of control devices and for the relationships between the application of a control device and the resulting ground-level concentration at a specified receptor location.

The mathematical models are then incorporated into a mathematical simulation which in essence describes a procedure for executing the models under prescribed conditions (such as a given meteorological situation or certain industrial process rates). The execution of the models results in a time or event history of responses for each model individually or for the entire system of interrelated models. This process is a mathematical simulation of a system described by mathematical models. If the mathematical models are executed according to the instructions contained in a computer program, then the mathematical simulation is referred to as a computer simulation or computer simulation model.

Normally, the results of a computer simulation are first used in a comparison with actual results observed in the real-world under conditions similar to those in the simulation. In the case of an air pollution control simulation, these results might be in the form of measured air quality data. If the comparison is good (that is, if the computer simulation results approximate the real-world measurements), then the simulation is said to be verified. A verified computer simulation implies a degree of confidence in the computer program's ability to simulate the system through mathematical expression. Based on this degree of confidence, the simulation can be used to predict the consequences of changes in real-world situations (for example, application of a new emission regulation). Careful judgment must be exercised, however, in determining the computer simulation's ability to predict the effect of situations far removed from those encountered in the verification process.

The enormous data-handling capabilities of digital computers and the programmed ability to step through complex sets of relationships have made the computer simulation solution an indispensible tool in the study of large-scale systems problems. With accurate models and simulations, the user can get information on the cost and effectiveness of various alternatives and, given certain prescribed objectives, these alternatives can be ranked in order of their desirability. When misused, of course, these analytic techniques lead to incorrect conclusions. "The computer sometimes makes intractable models tractable, but it always leaves incomprehensible models incomprehensible" [McMillan, 1966].

3.3 PROGRAM INPUT INFORMATION

A wide variety of input information is required by the Implementation Planning Program. A detailed breakdown of this information is given in conjunction with the discussion of each model in chapters 4, 5, and 6. The major classes of input information are meteorological data, air quality data, a source emission inventory, air pollution control technology, and descriptions of the emission standards to be used in candidate control strategies.

3.3.1 Meteorological Data

The meteorological data required by the Implementation Planning Program (Table 3-1) are those meteorological elements which have an important effect on the transport and dispersion of air pollutants [Tikvart, 1969].

TABLE 3-1 METEOROLOGICAL DATA ELEMENTS

- **WIND DIRECTION**
- **WIND SPEED**
- **STABILITY CLASS**
- **MIXING DEPTH**
- **AMBIENT TEMPERATURE**
- **AMBIENT PRESSURE**

The most obvious meteorological element is wind direction. This element determines whether or not the pollutant is transported from a pollutant emission source to a particular receptor location. The second element is wind speed. The stronger the speed of the wind, the greater is the amount of air available for dilution of the pollutant. The third element is atmospheric stability, which may be in the form of an arbitrary measurement based on time of year, amount of solar radiation, and wind speed; or it may be a conversion from data on vertical temperature differences. The fourth element is the mixing depth, which determines the amount of vertical mixing possible in the atmosphere. Normally, air pollutants can only mix through a relatively shallow atmospheric layer. The mixing depth may be as high as 5 or 6 thousand feet in the afternoon and only a few hundred feet at night.

These four most important meteorological data inputs are available from the National Weather Records Center (NWRC) operated by the Environmental Sciences Services Administration in Asheville, North Carolina. Here all meteorological data collected by Federal agencies are stored, tabulated, and summarized for the user's convenience.

3.3.2 Air Quality Data

To be compatible with the requirements of the implementation plan, an air quality monitoring network must provide data for comparison with air quality standards, analysis of emission control effects, evaluation of short-term emergency conditions, and verification of the atmospheric diffusion modeling (Table 3-2).

TABLE 3-2 AIR QUALITY DATA ELEMENTS

- **SAMPLING STATION LOCATION**
- **ANNUAL ARITHMETIC MEAN CONCENTRATION**
- **STANDARD GEOMETRIC DEVIATION**

The amount and quality of such data needed for the verification process cannot be stated in an absolute sense. Naturally, as more data becomes available and as the quality of the data improves, more confidence can be applied to the atmospheric diffusion modeling. The verification of the diffusion model is discussed at great length in Chapter 4.

3.3.3 Emission Inventory

An emission inventory is used to identify the existence of air pollution sources and to define the location, type, magnitude, frequency, duration, and relative contribution of the emissions from these sources [Bierbaum , 1969].

The ideal stationary source emission inventory would include emission estimates for every source in an air quality control region, as determined from stack gas sampling. Since this is not possible for all sources and pollutants, various techniques have been developed to estimate emissions from sources where the above data are not available. These techniques are discussed in greater detail in Chapter 6.

Several types of air pollution sources are encountered in any given metropolitan area. Generally, these sources can be divided into four major categories and several subcategories. The following is the breakdown used by the National Air Pollution Control Administration in presenting emission inventory data.

1. Fuel Combustion (stationary sources)
    - a. Residential - includes space heating, water heating, and cooking fuels
        1. Single family dwellings
        2. Multi-family dwellings
    - b. Commercial-Institutional-Governmental - includes mainly space-heating fuel
    - c. Industrial - includes space-heating, process heating, and steam and electric production fuels
    - d. Steam-Electric Power Plants - includes steam and electric production fuels
2. Industrial Process Losses - includes losses from all manufacturing processes
3. Solid Waste Disposal
    - a. Incineration
        1. Municipal
        2. On-site
    - b. Open Burning
4. Transportation (Mobile Sources)
    - a. Motor Vehicles
        1. Gasoline powered
        2. Diesel powered
    - b. Aircraft
    - c. Railroads
    - d. Ships

Information on these categories of pollution sources is further broken down according to two types: (1) Area sources and (2) Point

Sources. Area sources include small residential, commercial, governmental, institutional, and industrial fuel combustion operations, on-site solid waste disposal, and mobile sources. Point sources include major fuel users, incinerators, open burning dumps, and industrial process sources.

3.3.4 Emission Regulation Data

Legal regulations prohibiting or restricting emissions into the atmosphere have long been a major tool used by communities against air pollution. Many of the earlier control regulations were designed to effect a reduction in local nuisance problems. More recently, control regulations have been adopted with a view toward achieving a general improvement in the quality of a community's air resources.

Emission standards, from which emission regulations are developed, generally limit the amount of a pollutant which may be emitted into the atmosphere from a source (Figure 3-2). The allowable emission may be either directly stated (e.g., a process/weight-type standard) or implied (e.g., specification of a particular process or

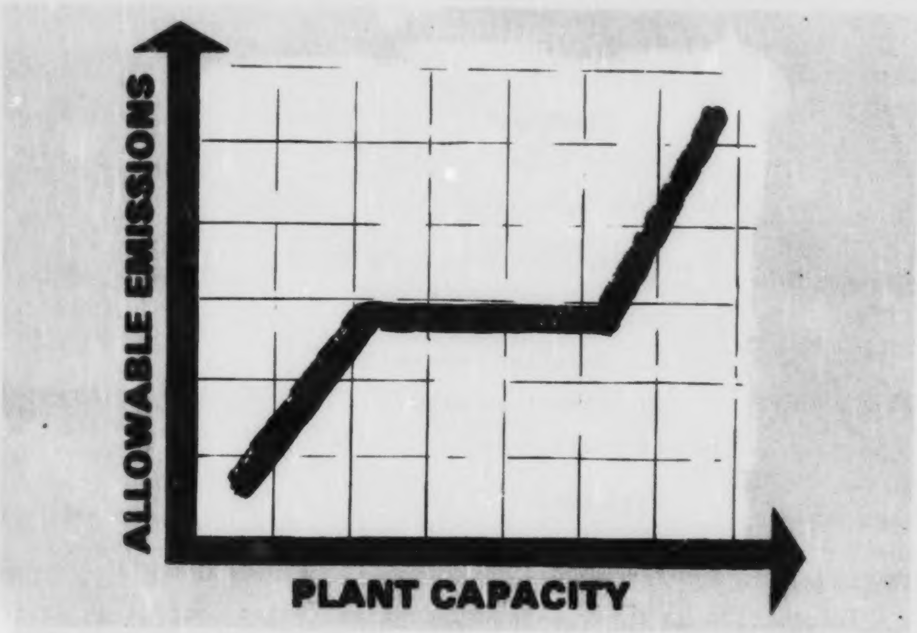

Figure 3-2 Typical Emission Standard Format.

fuel type). It is usually necessary to adopt several standards in order to control all the pollution sources in an area. For example, particulate pollution control may require separate standards covering industrial processes, fuel combustion, and solid waste disposal.

The specific emission standards to be used as candidates for a region's control strategy must be determined on the basis of many factors, including such aspects as types of industry and local availability of different qualities of fuel for combustion sources. The Implementation Planning Program has been designed to accept an infinite variety of emission standards, the only requirement being that the standards can be described in mathematical terms.

3.4 PROGRAM STRUCTURE

The Implementation Planning Program is divided into four separate elements: an Atmospheric Diffusion Model, Control Cost Model, and Control Strategy Model, and an Information System which stores and maintains air pollution control data and provides this data to each of the models (Figure 3-3).

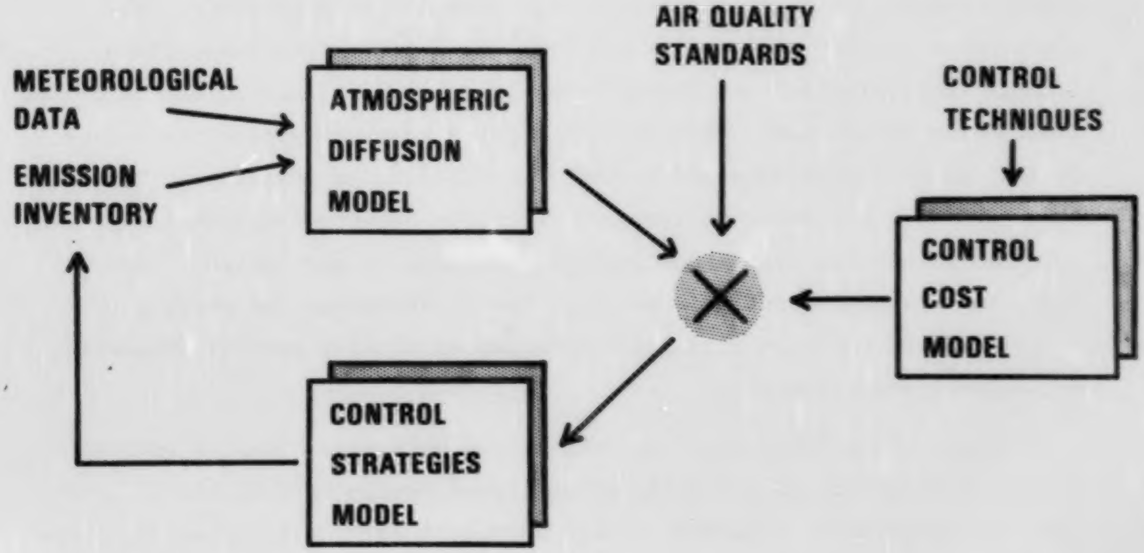
AIR QUALITY STANDARDS
METEOROLOGICAL DATA
EMISSION INVENTORY
ATMOSPHERIC DIFFUSION MODEL
CONTROL TECHNIQUES
CONTROL COST MODEL
CONTROL STRATEGIES MODEL

Figure 3-3 Implementation Planning Program Models.

The following is a summary description of each model and the Information System. A more detailed description is included in Chapters 4, 5, 6, and 7.

The purpose of the several models which constitute the Implementation Planning Program is to provide an integrated and comprehensive analytical tool to assess the air pollution problem in an air quality control region and to assist local officials in the development of control strategies designed to meet the regional goals.

The development of timely control strategies requires an extensive examination of various factors involved in the air pollution system, including meteorology, air pollution control technology, air pollution growth trends, source emission inventories, existing regional air quality conditions, and the cost impact of air pollution control. The Implementation Planning Program is a self-contained tool consisting of several models which take all of these factors into consideration in assessing the total impact of selected control strategies.

3.4.1 Atmospheric Diffusion Model

The first step in examining the existing or projected regional air quality conditions is an analysis of the movement of pollutants. The atmospheric transport of pollutants from any given source takes place through convection (due to the net air motion) and diffusion (due to random atmospheric turbulence). The pollutant plume moves away from the source in the downwind direction and expands laterally. The Atmospheric Diffusion Model provides mathematical transfer functions between individual source emission within the region and regional measures of air quality. In addition, the transfer functions are also used to determine the effects of various source emission standards contained in overall control strategies on regional air pollution.

Since the objective of the Atmospheric Diffusion Model is both to produce a frequency distribution of pollutant concentrations and to determine the individual influence of each source at each receptor point, a combination of two modeling techniques is used. A deterministic segment transforms source emission data into average ground-level long-term pollutant concentrations, and a statistical segment determines a corresponding frequency distribution for ground-level concentrations at different averaging times. It should be noted that the deterministic model alone cannot be used to develop a concentration frequency distribution, since the upper end of the distribution (i.e., those concentrations exceeded, say, one percent of the time or the expected annual maximum) occurs under short-term meteorological conditions.

The deterministic segment (Figure 3-4) computes the arithmetic annual average ground-level concentration resulting from specified area and point source emissions. For each receptor location, the model sums the effects of all sources over a complete range of meteorological conditions. Within a single run, the Atmospheric Diffusion Model considers both sulfur oxides and particulate matter pollutants.

An added feature to the operation of the deterministic segment is the use of a "correlation" option, a method of adjusting and verifying the model to make the computed ground-level concentration agree with available

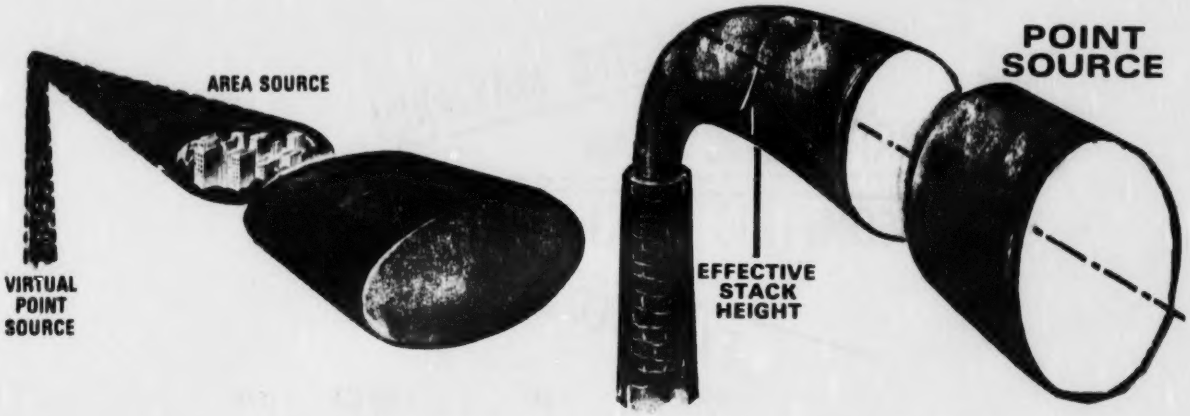

Figure 3-4 Point and Area Source Diffusion Calculated by Deterministic Segment.

measured ground-level concentrations. The method of adjustments uses least-square regression lines of measured concentrations on theoretical concentrations for each pollutant.

The statistical segment (Figure 3-5) uses correlated arithmetic averages of the deterministic segment and input values reflecting the geometric standard deviation for each pollutant to determine desired frequency distributions (i.e., maximum values and frequencies of occurrence with which specified values are exceeded). The key assumptions involved in the use of the statistical segment are that (1) ground-level air pollutant concentrations are approximately lognormally distributed for all pollutants and for all averaging times, and (2) the geometric standard deviations are known for each pollutant and are independent of the concentration magnitude but dependent upon its location within the region.

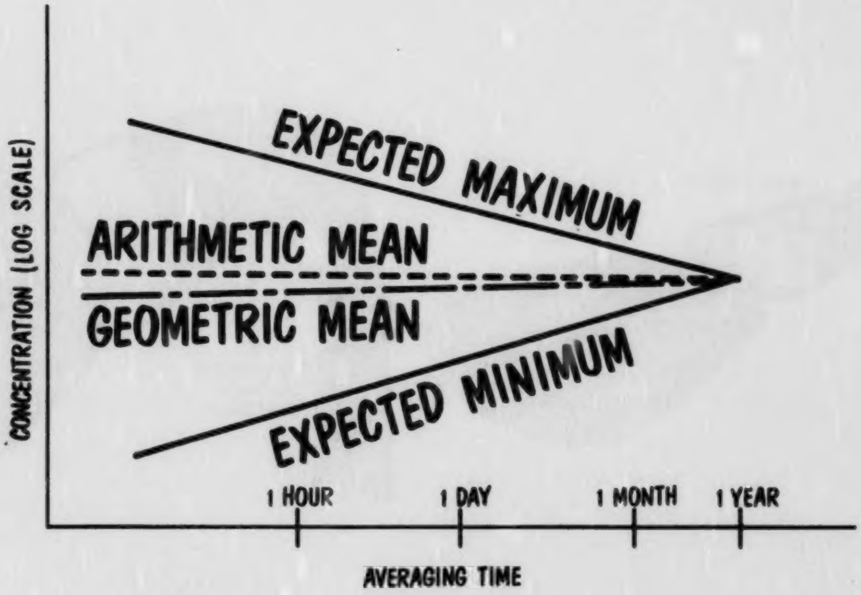

Figure 3-5 Statistical Distribution of Ground Level Concentrations.

3.4.2 Control Cost Model

The purpose of computing control cost and effectiveness values is to provide an indication of the lowest cost set of air pollution control measures which will satisfy required control regulations. The direct costs of these control measures, when summed over their application to all air pollution sources, provide estimates of regional air pollution control costs. By calculating the direct costs of air pollution control and the efficiencies of the selected control measures, this model provides the Implementation Planning Program with estimates of point source cost-effectiveness measures for evaluating candidate air pollution control strategies.

Each air pollution source (e.g., an industrial plant, power generating station, or apartment house) has one or more control-measure options for reducing its pollutant emissions. Each control measure has various cost and control efficiencies, depending on the source to which it is applied. The Control Cost Model sorts out applicable source control-measure combinations and provides the user with cost-effectiveness estimates for each specific point source or source category.

Figure 3-6 illustrates three possible controls applied for a specific size asphalt batching plant. Total annual costs are shown, including

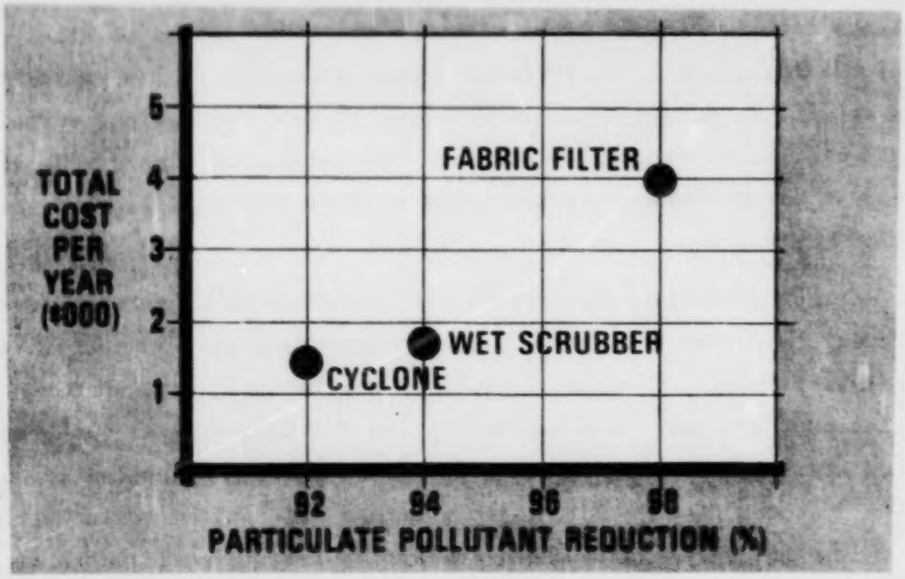

Figure 3-6 Typical Control Device Applications.

manufacturer's price, installation costs, annual capital charge, and operation and maintenance costs. In computing these major expense items, the model takes into account such factors as equipment depreciation schedules, interest rates on capital, and cost or credit for pollutant disposal. The model also considers variations in costs from region to region to account for equipment transportation costs, service utility connections, labor costs, etc.

The outputs of the Control Cost Model may be varied according to several user options. Output can be grouped to display the set of alternative control measures available to any single air pollution emission source, together with estimates of the annual cost and efficiency of each control measure. By further aggregation of the results, a similar display can be constructed for groups of sources (e.g., according to two-digit Standard Industrial Classification Codes) or for all combustion sources. Other options include displays of control measures with lists of applicable sources and their associated costs and efficiencies. Finally, the user has the option of inspecting the data file to obtain all information regarding the control cost and efficiency data supplied to the model.

3.4.3 Control Strategy Model

A control strategy is essentially a plan for reducing pollutant emissions from specific sources within a specified period of time. The emission limitations of a control strategy generally include emission standards applicable to air pollution sources or some regulations pertaining to fuel use, rules for the location of new industrial plants and other sources of air pollution, restrictions on open burning, plans for disposal of solid wastes, etc.

Control strategies are preventive or controlling schemes directed at particular pollution sources (e.g., combustion sources, industrial sources, Federal facilities) or selected types of regulations (e.g., process weight restrictions, zoning). The Implementation Planning Program can process a control strategy whereby maximum control technology is applied to fuel combustion sources, process weight restrictions are applied to industrial sources, and potential emission standards are applied to solid waste disposal sources. Figure 3-7 illustrates the types of combinations of strategies that can be considered in the program.

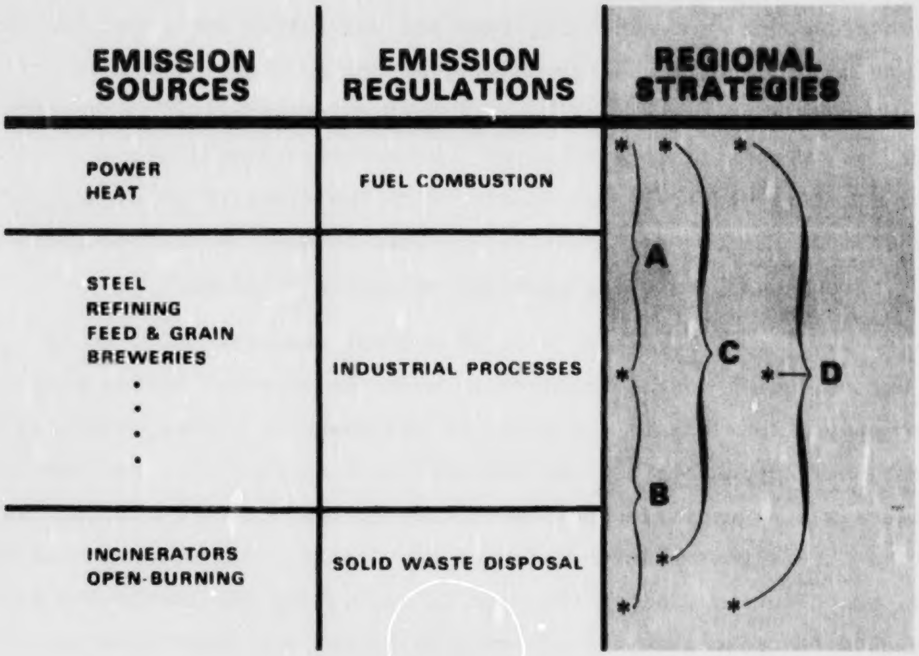
EMISSION SOURCES
EMISSION REGULATIONS
REGIONAL STRATEGIES
POWER
HEAT
FUEL COMBUSTION
STEEL
REFINING
FEED & GRAIN
BREWERIES
INDUSTRIAL PROCESSES
INCINERATORS
OPEN-BURNING
SOLID WASTE DISPOSAL
A
B
C
D

Figure 3-7 Control Strategies

The purpose of the Control Strategy Model is to provide a reasonably accurate and quantitative procedure for testing the impact of alternative control strategies in a computer-processed mathematical model. The Control Strategy Model provides a means for simulating and optimizing the control of regional air pollution source emissions, according to a variety of strategies aimed at achieving regional air quality goals, and assessing the degree to which these goals are met. The Model can thus be used as a "gaming" tool, with the user specifying a control strategy, observing the resulting change in regional air quality, and, on the basis of the results, modifying the specifications for another "run."

In the context of the Implementation Planning Program, a control strategy is considered to be an overall plan which specifies the types of air pollution sources to be controlled and method for their control, in order to reduce the chronic long-term and short-term air pollution problems. As long-term air quality objectives are made more and more stringent (i.e., through reductions in average long-term ground-level concentrations), frequencies of episode conditions will be correspondingly reduced. The Control Strategy Model, in conjunction with the statistical segment of the Atmospheric Diffusion Model, allows the user to observe the interaction between chronic and acute regional air pollution problems.

The model postulates the type of control measures which would be used by an air pollution source facility to meet the proposed source emission requirements. Inherent in the model is the assumption that individuals or corporations responsible for the air pollution sources will use control techniques which result in the lowest cost to the source facility. Simulation of a strategy with assumed lowest cost control measures applied to the sources of pollution assists the user in evaluating implementation plans with regard to reasonable ground-level pollutant concentrations and direct control costs. The Control Strategy Model provides sufficient information to evaluate the regional impact of selected strategies from the standpoint of: (1) the types of sources affected by the strategy; (2) the degree to which these sources are affected in terms of control costs; (3) the resulting change in pollutant emissions; and (4) regionally aggregated values of control costs by source category, total reduction in pollutant emissions, changes to regional fuel-use patterns, and resulting air quality levels.

3.4.4 Information System

The Information System used in the Implementation Planning Program is designed to store, maintain, and retrieve relevant air pollution control information for the models mentioned in the previous sections (3.4.1-3.4.3). The program that accomplishes these functions is written in the COBOL programming language, which is designed for data file maintenance procedures. The generality of this portion of the Implementation Planning Program permits the user a wide latitude in the types of input data stored and the variety of output reports generated from the stored information alone.

The detailed description of the Information System in Chapter 7 outlines the minimum information requirements to support the Atmospheric Diffusion Model, Control Cost Model, and Control Strategy Model.

The Information System is a generalized file-maintenance system using sequentially stored files on a disk memory. Each of the files (a Source Emission File, Control Device File, and Regional File) comprises a fixed number of records and a fixed number of fields per record. Standard COBOL report-writing routines are used to display the contents of this file. Although the record and field lengths of these files are fixed for a specific application of the Implementation Planning Program, they can be modified with relatively simple changes in the COBOL program.

3.5 PROGRAM OUTPUT INFORMATION

The models included in the Implementation Planning Program provide the user with a wide variety of output information. The program outputs have been designed to assist the user in developing and evaluating air pollution control strategies. Final decisions may thus be based on a combination of the experience and intuition of the user and the data processing of the computer simulation

The simplest output is in the form of reports displaying the contents of the data files. These reports are capable of summarizing the vast amount of data stored in the emission inventory file, control cost file, and regional data file. Several selected report formats are provided in the Implementation Planning Program (Chapter 7). However, the COBOL structured Information System encourages the user to have specific reports designed to meet his own needs.

The Atmospheric Diffusion Model provides the user with two forms of contour maps and a variety of tabular data. The contour maps are generated as a result of an IBM punched-card output deck which is designed to provide x-y plotting charts or SYMAP shaded-area diagrams (Figure 3-8) on a line printer. Both of these techniques are described more fully in Chapter 4. In addition to the contour diagrams, this model provides tabular data on average ground-level concentrations and statistical data on expected maximum concentrations. The tabular data is in the form of a grid system, an arrangement which makes it easy to accurately locate specific receptors in a region.

The Control Cost Model provides one standard output showing the types of control measures that are applicable to each type of pollutant source. Along with the control measure identification, the model calculates annual costs and expected emission reduction efficiency as applied to a specific source.

The Control Strategy Model contains the emission standards which, in most cases, require the application of the control measures identified by the Control Cost Model. The output of this model illustrates the actual control measures selected for each source, together with the annual costs and data on the degree to which emissions have been controlled. The model also displays the conversion from emission reductions to reductions in annual and expected maximum ground-level concentrations for selected emission standards. A regional summary culminates this model's output and includes a description of regional costs, regional emissions, number of sources affected by a given standard, and figures of merit for each strategy (e.g., cost per ton of pollutant removed, cost per microgram/cubic meter of reduced ground-level concentrations).

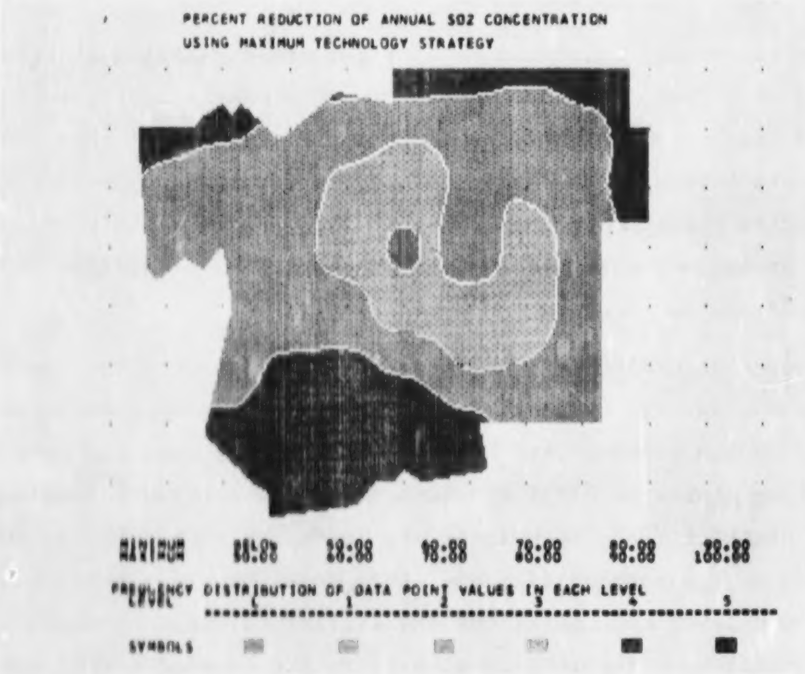
PERCENT REDUCTION OF ANNUAL SO2 CONCENTRATION
USING MAXIMUM TECHNOLOGY STRATEGY
MINIMUM
MAXIMUM
FREQUENCY DISTRIBUTION OF DATA POINT VALUES IN EACH LEVEL
LEVEL
0
1
2
3
4
5
SYMBOLS

Figure 3-8 Pollution Reduction Due To A Maximum Control Strategy.

4.0 ATMOSPHERIC DIFFUSION MODEL

4.1 PURPOSE

The purpose of the Atmospheric Diffusion Model is to determine the relationships (transfer functions) between individual source emissions within the region and pollutant concentration values at selected sites. The transfer functions are then used:

(a) by the Atmospheric Diffusion Model to provide estimates of existing air quality; and

(b) by the Control Strategies Model to determine the effects of various emission control strategies on regional air quality.

The Atmospheric Diffusion Model is based on a mathematical simulation of the atmospheric diffusion process developed by Martin and Tikvart [1968]. In its current form, the model has three modes of operation which differ according to the way in which they utilize the diffusion simulation to perform various functions. These operational modes are as follows:

(a) A Calibration Segment designed to calibrate the estimated arithmetic mean pollutant concentration output from the diffusion model with available measured air quality data. The procedure involves determination of a set of least-squares regression lines which relate the measured and estimated concentration values for each pollutant-season* combination. The regression line coefficients are then used in the diffusion model to produce calibrated pollutant concentration values at any selected receptor point within the region.

(b) A Receptor Concentration Segment which uses the calibrated diffusion model to calculate the total calibrated arithmetic mean pollutant concentration values at selected receptor points throughout the region. A set of values may be calculated for any combination of three seasons and three pollutant types. This data is then output in tabular form. If requested, the data will also be output in punched card form for use in contour plot applications.

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*In this section "season" refers to the 3-month summer or winter period or the 12-month annual period.

This segment also calculates and stores the transfer functions for all pollutants during the annual period for use by the control strategies model.

(c) An Analysis Data Output Segment in which the mean concentration data for the annual period is used to produce the following types of data tables for each pollutant considered:

(1) Excess Table - Lists those receptors which exceed the regional standard and provides information on the point and area source contributions to each such receptor.

(2) Source Contribution Table - Lists the individual source contributions to the five highest-concentration receptors or, if desired, to any five selected receptors.

(3) Statistical Table - Lists maximum and three selected percentile concentration values for 12 selected receptors. The table may be repeated for each of five selected averaging times.

4.2 INPUT INFORMATION

Data is input to the program both from the disk memory file system (containing the source data) and from punched cards (containing option flags, meteorological data, calibration data, etc). The types of input requirements for each operational mode of the program are described in the following sections. The input card formats and data file creation or modification procedures are discussed in Sections 8.1 and 8.2 respectively.

4.2.1 Calibration Data

In addition to the diffusion model data described in Section 4.2.2, the following input data is required for calibration of the diffusion model.

Measured Air Quality Data. For each pollutant-season combination for which the diffusion model is to be calibrated, data from 3--100 measuring stations may be specified. The data includes station locations (which may differ for each pollutant type) and measured arithmetic mean concentration levels ($\mu g/m^3$)* for each pollutant-season combination.

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*$\mu g/m^3$ = micrograms per cubic meter.

Station locations are specified with respect to the same origin used to specify the emission source locations.

4.2.2 Diffusion Model Data

The following inputs are required for execution of the diffusion model:

(a) Basic Receptor Data. Up to 225 regularly spaced receptors may be specified, together with 50 individually located receptors. These receptor locations are used for all pollutant-season combinations. The regularly spaced receptors are defined by intersections in a grid pattern having equidistant vertical and horizontal spacing. The grid pattern is determined by the location of its southwest corner (with respect to the source origin), the number of rows and columns of receptors, and the distance between adjacent rows and columns.

For identification purposes, the receptors are numbered consecutively, starting with the southwest corner of the grid pattern, running through the columns, and ending with the individually located receptors. This basic set of receptor identification numbers is used to specify particular receptors for output purposes.

(b) Source Data. Both area and point sources may be input. The location, average emission rate (tons/day) for each pollutant-season combination, and exhaust stack parameters must be specified for each point source. The stack parameters, which include physical stack height, stack exit diameter, effluent exit velocity, and effluent temperature, are used to obtain the effective height of release (i.e., the height at which the plume becomes horizontal) for use in the diffusion calculations. If the stack parameters are not known, an effective stack height value may be input. For each area source (assumed to be square in shape), the area, average emission rate (tons/day) for each pollutant-season combination, and the effective height of release must be input. At the option of the user, the set of area source locations may specify either the southwest corner or the centroid of each input area source.

(c) Stability Wind Rose Data. This data gives the relative frequency of occurrence for each wind direction, wind speed class, and stability category combination as observed for the region and seasons of interest. Although the wind direction is a continuous variable, for purposes of computation it is specified in sectors corresponding to 16-point compass headings, with sectors 1 through 16 corresponding to winds blowing from the directions N, NNE, NE,....., NW, and NNW, respectively. Since there are 5 stability classes, 16 wind directions, and 6 wind speed classes, the complete set of stability wind rose data consists of 480 frequency values. When summed over all categories, the relative frequency is 1.0. The diffusion model utilizes a single set of stability wind rose data for each season.

(d) Mixing Depth. The mixing depth is defined as the depth above the surface through which the pollutant is mixed. Since this depth varies greatly from season to season, day to day, and diurnally, it is practical to account for only major changes. The program uses a single input value for each season--the average afternoon mixing depth --and modifies it according to the stability class. If the mixing-depth value is not available, it may be estimated from Holzworth's [1964] estimates of the monthly mean afternoon mixing depths in the contiguous United States.

(e) Ambient Temperature and Pressure. Ambient temperature (^{o}K) and pressure (Mb) values are required for each season considered. These values are used in calculating the effective stack height.

(f) Pollutant Decay Factors. To account for the decay of pollutants in the atmosphere, each pollutant-season combination may be assigned a half-life value (hrs). For SO_2, a half-life of approximately three hours is appropriate. To account for removal of other pollutants, a half-life of several hours may be used.

(g) Background Concentration. For each pollutant-season combination, a value for the background concentration ($\mu g/m^3$) may be specified. These values are assumed to apply uniformly throughout the region.

(h) Correlation Data. If the regression coefficients applicable to the set of diffusion model data being utilized are known, they may be input directly. One set of coefficients is required for each pollutant-season combination.

4.2.3 Analysis Data Output Requirements

The Analysis Data Output tables may be requested for the annual period only. The input required for each of the three types of tables consists of the following:

(a) Excess Table.

Air Quality Standard. For each pollutant considered, the annual arithmetic mean concentration value ($\mu g/m^3$) not to be exceeded must be specified.

(b) Source Contribution Table. This table may be output for the source contributions to the five highest-concentration receptors (for each pollutant) or for the source contributions to five selected receptors. If the latter option is selected, the required input consists of:

Output Receptor Selection. For each pollutant, five receptors(selected from the basic receptor set) may be specified for source contribution output.

(c) Statistical Table

(1) Output Receptor Selection. For each pollutant, a maximum of 12 output receptor locations may be selected from the basic set (for which arithmetic average concentrations have been computed).

(2) Standard Geometric Deviation. For each of the selected output receptors, a standard geometric deviation value for a 24-hour averaging time must be input for each pollutant (the program automatically converts this value to the desired output averaging time). For output receptors located at measuring sites, the standard geometric deviation values will be obtained from the measuring station data. For output receptors not located at measuring sites, the standard geometric deviations must be interpolated from nearby measuring station values.

(3) Averaging Time. Up to 5 different averaging times for each pollutant type may be specified. A set of data will be output for each averaging time selected.

(4) Output Percentile Values. Up to three percentile values may be specified for each pollutant-averaging time combination.

4.3 PROGRAM OPERATION

This section presents an engineering description of the operations and data manipulations involved in operation of the model.

4.3.1 Calibration Procedure

The calibration procedure (repeated for each pollutant-season combination selected) begins with the use of the diffusion model to calculate the concentration values at each of the input measuring sites. Since the calculated concentration values at the measuring sites do not include the background concentration, as the measured values do, direct comparison, between the two is not desirable. To enable a direct comparison, (i.e., correlation) to be made, the program will subtract the background concentration from each of the measured values. For descriptive purposes, the measured minus background concentrations are defined here as "observed concentrations."

A least-square regression line of observed concentration values on calculated values is then obtained. This procedure is used to determine the straight line which best fits the plot of calculated vs observed concentrations. The scatter diagram below illustrates the procedure. Each point plotted represents both the calculated and observed concentration values at a given receptor. For each pollutant-season combination, then, there is a regression line:

$$\hat{\chi}_{pt} = A_{pt} + B_{pt} \ \chi_{pt}, \qquad (1)$$

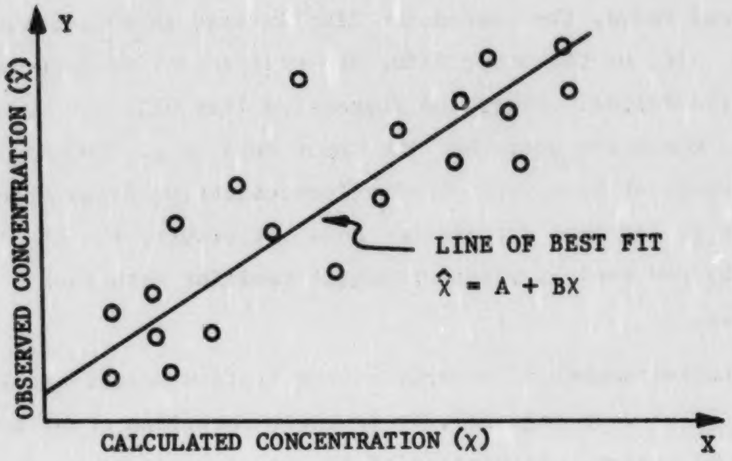
where

$\hat{\chi}_{pt}$ = observed concentration of pollutant p during season t

χ_{pt} = calculated concentration of pollutant p during season t

A_{pt} = y-axis (observed concentration) intercept of best-fit line for pollutant p and season t data.

B_{pt} = slope of best-fit line for pollutant p and season t data.



If the regression line adequately describes the relationship between the observed and calculated concentration values, it may then be applied to the region in general (within the range of calculated values used to determine the regression line). The diffusion model output would thus be adjusted at each receptor point according to the equation:

$$\chi'_{pt} = A_{pt} + B_{pt}\ \chi_{pt} + (\chi_{BG})_{pt} \tag{2}$$

where

χ'_{pt} = total calibrated pollutant concentration for pollutant p during season t.

$(\chi_{BG})_{pt}$ = input background concentration for pollutant p during season t.

To determine if the regression lines are adequate, the coefficient of correlation, a measure of data-scatter about the regression line, is calculated and compared with the maximum theoretical value that could arise due to chance.* The maximum theoretical value is determined for a 5% confidence level (that is, there are fewer than 5 chances in 100 that a coefficient of correlation as high as this value would arise due to random sampling variation). If the coefficient of correlation is greater than the theoretical value, the regression line is used to adjust the calculated values. If, on the other hand, the coefficient of correlation is less than the theoretical value, the regression line will not be used. A poor correlation warns the user that the input data (e.g., emission inventory, meteorological data, and observed concentration data) should be revised and, if an improved correlation does not result, the model assumptions should be reviewed by a meteorologist familiar with such modeling techniques.

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*For a general discussion of these concepts, see Fisher [1954].

If only a limited number of observed concentration values are available (fewer than 20 for most regions), or if their locations cover only a small portion of the region, calibration of the model may not be meaningful. However, it would still be of interest to check the model output with available measured data. In this way at least a partial check of the model's adequacy can be made. So that such checks may be performed and the regression results analyzed prior to region-wide application, the program has the following options:

OPTION	PROGRAM DESCRIPTION
0	The user must input the regression constants A_{pt} and B_{pt}. The program will apply the resulting regression line equations to the calculated concentration values prior to output. If, for any season-pollutant combination, uncalibrated output is desired the regression constants must be input as $A_{pt} = 0$ and $B_{pt} = 1$.
1	The program will determine the regression lines and, if correlation is good, will adjust calculated concentration values accordingly. If the correlation is poor, the calculated concentrations will be output without adjustment and a message printed to indicate that poor correlation was obtained. In either case, the regression constants and correlation coefficients are output.
2	The program will determine the regression lines and correlation coefficients and stop.

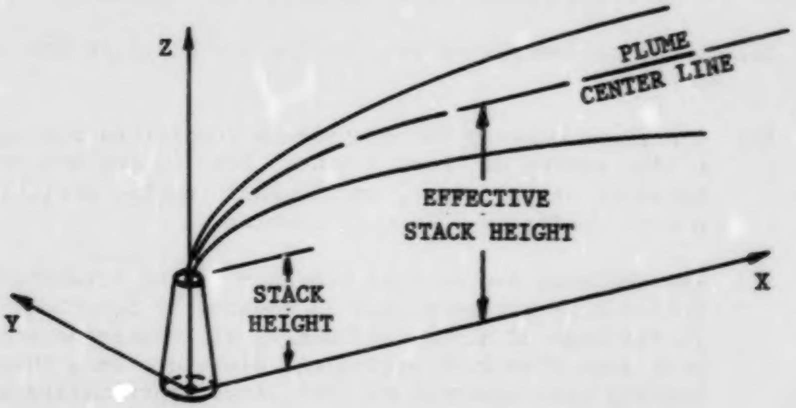
Since model calibration is usually a trial-and-error process involving refinement of the input data, Option 2 is most economical. Once good correlation has been achieved, Option 0 can be used. (Note, however, that if input background values are used when determining the coefficients A_{pt} and B_{pt} in Option 2, then the same background input values must be used in Option 0.)

4.3.2 Diffusion Model Description

The Atmospheric Diffusion Model Segment is based upon a diffusion model developed by Martin and Tikvart [1968]. The basic output of the model is in the form of calculated average seasonal pollutant concentrations at ground level. Concentrations for shorter periods are estimated by means of a statistical technique developed by Larsen [1969] and discussed in Section 4.3.3.

The Martin-Tikvart model calculates concentrations downwind from a set of point and area sources on the basis of the Pasquill [1962] point source formulation. A description of this process follows:

The stack in the following illustration represents a typical elevated point source. The coordinate system for this source has its origin at ground level at the base of the stack (i.e., directly below the effective point of emission). The X-axis extends horizontally in the mean wind direction. The Y-axis is horizontal in the cross-wind (and cross-plume) direction. The Z-axis is vertical.



The "effective stack height" (or effective height of emission release) is the height at which the plume center line becomes horizontal. The effective stack height is the sum of the physical stack height and an incremental factor related to the buoyancy and vertical momentum of the effluent.

The concentration, χ, at a position (x,y,z) for substances emitted at (0,0,h) is given by

$$\chi\,(x,y,z;\ h) = \frac{10^6 Q}{2\pi\sigma_y\sigma_z u}\ \exp\left[-\frac{1}{2}\left(\frac{y}{\sigma_y}\right)^2\right]\left\{\exp\left[-\frac{1}{2}\left(\frac{z-h}{\sigma_z}\right)^2\right] + \exp\left[-\frac{1}{2}\left(\frac{z+h}{\sigma_z}\right)^2\right]\right\} \qquad (3)$$

where:

$\chi(x,y,z;\ h)$ = pollutant concentration, micrograms/meter^3, at point x,y,z for an effective stack height h.

Q = emission rate, grams/sec.

u = mean wind speed, meters/sec.

σ_y, σ_z = standard deviation of the plume concentration distribution in the cross-plume and vertical directions, meters. (σ_y and σ_z are given as functions of downwind distance and atmospheric stability, Gifford [1961]).

Equation (3) is based upon several assumptions, including:

(a) Total reflection of the plume takes place at the earth's surface.

(b) The plume description represents conditions averaged over a time period of about 1 hour. The "instantaneous" behavior of the plume, particularly during unstable atmospheric conditions, is more complex.

(c) The effluent has neutral buoyancy in the atmosphere; no fall-out or buoyancy rise is modeled by Equation (3). In the case of actual effluents, all contaminant gases and most particles with equivalent diameters less than 20 microns satisfy this assumption. For larger particulate material, the simple plume description is not applicable.

(d) The time-averaged plume exhibits a Gaussian distribution of concentrations in the cross-plume and vertical dimensions. The measures of the spread in both directions (the standard deviations) are considered to be a function of downwind distance and atmospheric stability only.

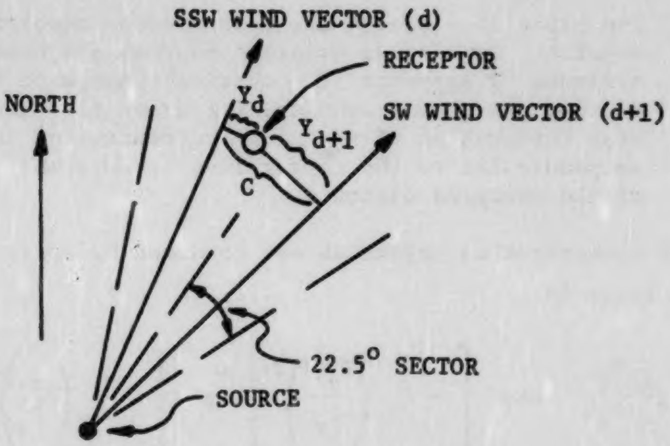
(e) The plume is a steady-state phenomenon resulting from a constant, continuous emission source, and none of the effluent "disappears" (by chemical change or by absorption on the ground surface, for example). Thus, an area integration of the plume concentration in any plane perpendicular to the center line is constant, regardless of the downwind distance.

Ground-level concentration estimates are obtained by setting z = 0 in Equation (3), resulting in

$$\chi\,(x,y,z;\,h) = \frac{10^6 Q}{\sigma_y \pi \sigma_z u} \exp\left[-\frac{1}{2}\left(\frac{y}{\sigma_y}\right)^2\right] \exp\left[-\frac{1}{2}\left(\frac{h}{\sigma_z}\right)^2\right] \qquad (4)$$

For a source which emits at a constant rate from hour to hour and day to day, Equation (4) can be modified to yield estimates of long-term (seasonal) average concentrations if applicable stability wind rose data are available. A wind rose tabulates the frequency of occurrence for each wind direction and wind speed class during a standard climatological period. A stability wind rose contains the same information, but it is further divided according to atmospheric stability classes.

Although the change in wind direction is a continuous function over the long-term period, for computation purposes discrete wind directions are specified with respect to a 16-point compass, corresponding to 22.5-degree circular sectors. For seasonal periods it is often assumed that all wind directions within a given 22.5-degree sector occur with equal frequency. Thus the effluent could be assumed to be uniformly distributed in the horizontal within the sector. However, this assumption would result in discontinuities in calculated concentrations at sector boundaries. A more reasonable distribution is obtained by using a linear interpolation between sector center lines. Thus, the concentration at a given receptor location is composed of proportional contributions from both the sector containing the receptor and from the nearest adjacent sector. The linear interpolation term is given by (c-y)/c, where y is the crosswind distance between the receptor and the sector center line, and c is the sector width at the receptor location. This concept is illustrated in the following sketch. Note that a SSW wind affects the receptor to the NNE of the source.



Use of the linear crosswind distribution requires that the form of Equation (4) be changed to reflect a univariate Gaussian distribution:

$$\chi = \frac{2\cdot 10^6 Q(c-y) \;/\; c}{\sigma_z u\sqrt{2\pi}\,(2\pi x/16)} \exp\left[-\frac{1}{2}\left(\frac{h}{\sigma_z}\right)^2\right] \qquad (5)$$

Vertical plume rise is inhibited by the existence of a stable atmospheric layer having a base lower than the effective stack height (the layer elevation will generally range between 100 and 3,000 meters). The rate of vertical mixing is greatly reduced in such a layer. The base of the layer can thus be considered as an effective "lid" on vertical transport of pollutants.

When an elevated stable layer occurs locally, the estimated pollutant concentrations can be calculated with the assumption that all the effluent remains within a mixing layer depth L, defined as the vertical distance from the ground to the base of the stable layer. For the model calculations, σ_z is considered to increase in the downwind direction until it reaches a distance X_L at which $\sigma_z = 0.47L$. Up to this distance, the Gaussian vertical distribution is assumed, and Equation (5) is appropriate. At distance X_L

the trapping effect of the elevated stable layer begins to be effective, and uniform mixing below the base of the stable layer is assumed to occur at downwind distance $2X_L$. For distances $X \quad 2X_L$, the average concentration is calculated with the assumption of full mixing in the mixing layer:

$$\chi = \frac{10^6 Q(c-y) \ / \ c}{Lu(2\pi x/16)} \qquad (6)$$

For distances between X_L and $2X_L$, χ is determined by a linear interpolation between Equation (5), evaluated at X_L, and Equation (6), evaluated at $2X_L$.

For a specific receptor, r, and source, s, configuration, an estimate of χ_{rs} for each pollutant is obtained by choosing a representative wind speed for each wind speed class and solving the appropriate equation for every wind speed and stability classes appropriate for the season in the geographical area of interest. The average concentration, $\overline{\chi}_{rs}$, is obtained by summing all concentrations and weighting each one according to its frequency for the particular wind direction, wind speed class, and stability class. The average concentration for a given pollutant-season is:

$$\overline{\chi}_{rs} = \sum_{d=1}^{16} \sum_{n=1}^{6} \sum_{c=1}^{5} F_{dnc} \ \chi_{dnc} \qquad (7)$$

where:

F_{dnc} = normalized frequency during the period of interest for wind direction interval d, wind speed class n, and stability class c.

χ_{dnc} = average ground-level concentration calculated from (5) or (6) as appropriate.

For each of the 16 wind direction intervals, wind speed is defined in six categories and stability class in five categories. Thus a three-dimensional array of 480 categories is established. (However, only a few wind directions result in non-zero contributions for specific source-receptor pairs. Thus the computation time is reduced significantly.) Vertical variations in wind speed and wind direction are not accounted for in the present model.

The representative speeds associated with the six climatological wind speed categories (0-3, 4-6, 7-10, 11-16, 17-21 and >21 knots), are given by the five mid-interval values of 0.67, 2.46, 4.47, 6.93 and 9.61 meters per second, and by 12.52 meters per second (= 25.5 knots) for the >21 knots category.

The five stability categories (S = 1, 2, 3, 4 and 5, in order of increasing atmospheric stability) are defined on the basis of the criteria stated by Turner [1964]. Stability in the lowest part of the atmosphere is determined primarily by the net radiation and local wind speed. Turner's classification is based upon ground-level meteorological observations only (surface wind speed, cloud cover, ceiling), supplemented by solar elevation data (latitude, time of day, and time of year); thus the stability estimates can be obtained for any Weather Bureau station at which continuous observations have been made.

The total concentration at a specific receptor r for a given pollutant-season is

$$\chi_r = \sum_s \overline{\chi}_{rs}, \tag{8}$$

where

$\overline{\chi}_{rs}$ = the average estimated concentration at receptor r from source s, as given by Equation (7).

Using the calibration constants and background concentration values, the total calibrated mean concentration values at each receptor (for each pollutant-season combination) is now given by

$$\chi_r' = B\chi_r + A + \chi_{BG} \tag{9}$$

The values of σ_z (X,S) used in the program are those of Pasquill [1961] and Gifford [1961]. For computation these are represented in the form $\sigma_z = aX^b + c$, where a, b and c are constants for each stability class, as shown in the following table. No a, b and c values are stated for S = 5 in the table. Class 5 is associated with nighttime, surface inversion conditions, and the σ_z values for this case are the smallest normally used. However, because of the thermal and mechanical influences of urban areas, the lowest part of the typical urban atmosphere is less stable than its rural counterpart. Since the diffusion model is intended for use in urban regions, the σ_z values for $S = 4$ are always used when the meteorological criteria indicate $S = 5$.

The minimum value of X used in calculating σ_z is 100 meters. If X < 100 meters, X is set equal to 100 meters prior to the σ_z calculation.

Stability Class (S)		a	b	c
1 ∿ Very Unstable		.001	1.890	9.6
2 ∿ Moderately Unstable		.048	1.110	2.0
3 ∿ Slightly Unstable		.119	.915	0.0
4 ∿ Neutral	$X > 1000$ meters	2.610	.450	-25.5
	$X \leq 1000$ meters	.187	.755	- 1.4

The mixing layer depth, L, varies greatly from season to season, day to day, and diurnally. Since it is impractical to account for all these variations, a procedure reflecting only major changes is used in the model. The procedure determines an effective mixing depth by modifying the average afternoon mixing depth values, as tabulated by Holzworth [1964], according to the stability class being considered. Stability classes $S = 1$, 2 and 3 are afternoon conditions, with $S = 1$ corresponding to very unstable conditions. When $S = 1$, the value of L is assumed to be 50% greater than the climatological value tabulated by Holzworth; when $S = 2$ or 3, the climatological value is adopted. According to Turner's criteria, $S = 5$ can occur only when nighttime ground-based inversion conditions exist. Since a shallow layer of neutral or weak lapse conditions has been found to occur over urban areas (even with strong nocturnal surface inversions in the surrounding rural areas), a mixing depth of $L = 100$ meters is adopted for stability class $S = 5$, when this class is indicated by the objective criteria. The 100-meter value is based upon observations of Clarke [1969]. Stability class $S = 4$ is a neutral stability condition which occurs either with high wind speeds during the day or with cloudy conditions during the night. To find the mixing depth for the transition period between day and night, the afternoon mixing depth values are averaged for 2/5 of the class S = 4 occurrences. The remaining 3/5 of the class utilizes the climatological value.

The effective stack height, appearing in Equation (5), is defined as the height of the plume centerline when it becomes horizontal. Thus $h = h^* + \Delta h$, where h^* is the physical stack height and Δh is the plume rise. The effective stack height does not appear in Equation (6) because the height of emission is immaterial after vertical mixing is complete.

The plume rise equation used in the program (when actual point sources are being considered) is due to Holland [1953], and is given by

$$\Delta h = \frac{V_s d}{u} \left[1.5 + 2.68 \times 10^{-3} P \left(\frac{T_s - T_a}{T_s} \right) d \right] \qquad (10)$$

where:

V_s = stack gas-exit velocity (meters/sec.)

d = stack exit diameter (meters)

u = mean wind speed (meters/sec.)

P = atmospheric pressure (mb)

T_s = stack gas-exit temperature (°K)

T_a = ambient air temperature (°K)

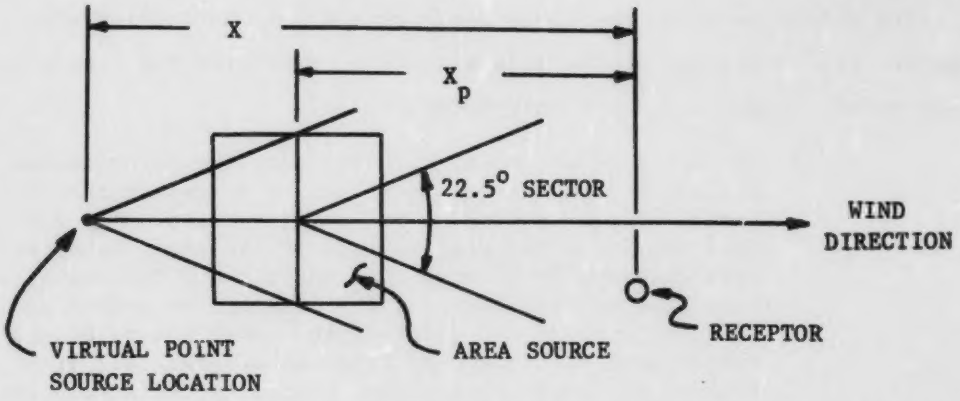
Since this equation is appropriate for the neutral stability condition, it must be modified when applied over a range of stability conditions. The following modification is used to allow for a range of from 1.3 Δh for very unstable conditions to Δh for neutral stability.

$$h = h^* + \Delta h(1.4 - 0.1S)$$

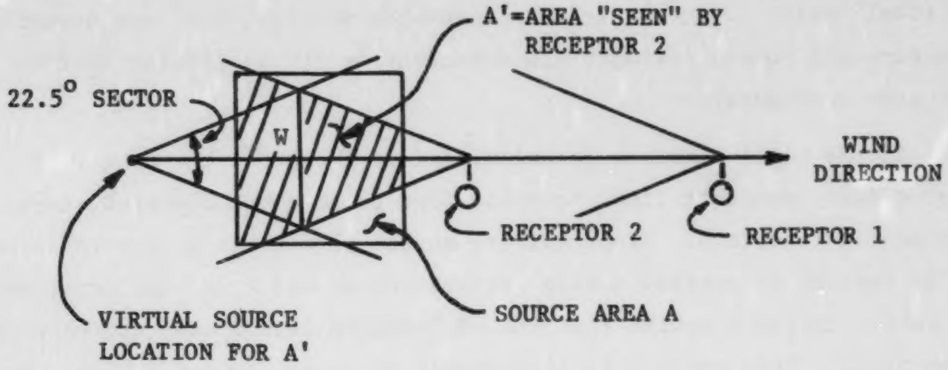
The plume rise Equation (10) frequently underestimates the effective height of emission; thus its use often provides a slight "safety" factor. For some point sources (e.g., power plants with tall stacks), the effective emission height will be above the mixing depth when the mixing depth is low. Based on the assumption that the plume will not disperse downward through the stable layer, these cases are identified and eliminated from consideration by the program. For area sources an average effective height of emission must be estimated.

The program handles area sources by converting them to equivalent or "virtual" point sources. In the conversion process, both the downwind distance and source strength are dependent on the particular source-receptor configuration.

If the total emission is calculated as though at the center of the source area, concentrations downwind tend to be overcalculated, especially for nearby receptors. Since uniform spread across the sector is assumed, it is logical to proceed a step further and assume a virtual point source at such a distance upwind that the 22.5-degree sector used subtends the area width. This concept is illustrated in the following sketch. Here the program would use X instead of X_p as the source-receptor downwind distance in Equation (5) or (6). The vertical spread, as measured by σ_z, is still calculated using X_p, the actual downwind distance.



In a similar manner, nearby receptors are affected by emissions from only a portion of the source area and, therefore, would be overcalculated if the total area emission value were used. To correct this, the source emission rate is multiplied by an "area utilization" factor, Q*, which is the ratio of that portion of the source area lying within a 22.5-degree sector upwind of the receptor (A') to the total area (A). For example, in the sketch on the following page, Receptor 1 would use the total area-emission value, Q, while Receptor 2 would use the proportional amount, QQ* = Q(A'/A). Note that in this figure the virtual point source would be defined by the reduced area width, W.



To account for decay of the pollutant from the atmosphere, a pollutant decay factor is applied to the calibrated concentration value χ_r' (equation 9). The time-based decay factor is given by exp[-.693(x/u)/(T 3600)], where T is the pollutant half-life in hours.

The diffusion model described above should only be applied when competent meteorological advice is available to interpret the limitations in the model. Important cautionary notes include:

(a) The basis of the model calculations, the point source diffusion formula, was developed to represent the behavior of plumes from actual point sources. The field data available for confirmation of the plume behavior were obtained from open, flat terrain and for travel distances of no more than a few kilometers in most cases. Thus, the use of the point-source model for urban scale projections has three specific weaknesses: (1) area sources are only imperfectly modeled by "effective point sources"; (2) plume behavior during horizontal transport of more than a few miles is not well known; and (3) plume behavior in regions of varying thermal and surface-roughness characteristics has not been systematically observed.

(b) The climatological data used in the model calculations are obtained from airport weather observing stations in nearly all cases. Frequently, the character of the lower atmosphere varies significantly between an out-of-town observation site and the urban central region.

(c) The use of surface meteorological data only in the estimation of mixing-layer depths has not been very successful. Better modeling should result when climatological data based upon vertical wind and temperature soundings is used.

(d) The emission inventories presently available for use in the model calculations are subject to error, and they cannot fully describe the variability within the urban region.

(e) The present model uses seasonal average emission inventory data. However, significant diurnal and seasonal variabilities in emission rates normally occur. Such variabilities are often (partially) correlated with the stability wind rose data. A future version of the model should include co-variable meteorological and emissions data in the development of seasonal average concentration estimates.

The listing of limitations cited here is not intended to imply that the present model be kept from use. On the contrary, improved models can only be developed when significant experience with the present formulation has been achieved.

4.3.3 Analysis Data Tables

In general, the data manipulations involved in determining the Analysis Data Table output are conversions of the total calibrated mean concentration values (for the annual period) to individual source concentrations (Excess and Source Contribution tables) and short-term concentration values (Statistical Table). The specific equations used for each type of table are given below.

Excess Table Calculations

For each pollutant the calibrated concentration at receptor, r, from each source, s, is given by

$$\overline{\chi}'_{rs} = B\overline{\chi}_{rs} + A\left(\frac{\overline{\chi}_{rs}}{\chi_r}\right), \qquad (11)$$

where B and A are the calibration coefficients for a given pollutant as determined in Equation (1) and $\overline{\chi}_{rs}$ and χ_r are defined by Equation (8).

The Excess Table requires the contribution from the set of point sources and the set of area sources. These values are obtained by summing Equation (11) over all point sources and then over all area sources.

An additional requirement of the Excess Table is to tabulate the percent emission reduction required to reduce the excess concentration $(\chi_r' - \chi_{standard})$ to zero. The percent reduction is given for point source control only and for control of all sources.

Source Contribution Table

This table presents the individual source and background contribution $\bar{\chi}_{rs}'$ to each of a selected set of receptors. The calculation of $\bar{\chi}_{rs}'$ is given by Equation (11).

Statistical Table

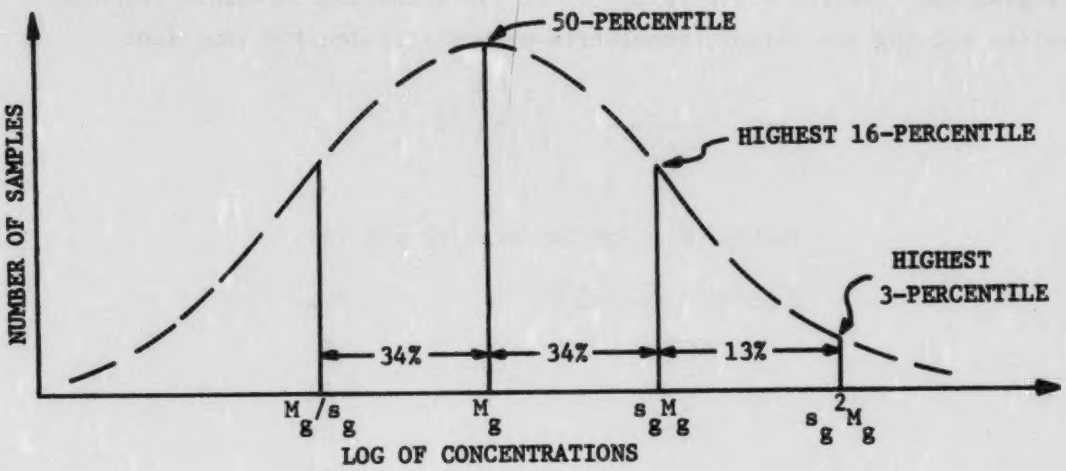
Larsen [1969] has developed a mathematical model for the expression of air pollution concentration as a function of averaging time and frequency, and has demonstrated how the model can be used to relate air quality criteria to air quality standards and emission standards. The model is employed here to convert arithmetic average concentrations to expected maximum concentrations and expected geometric mean and percentile concentrations for various averaging times, under the assumption that the standard geometric deviations are known.

The Larsen model was constructed on the basis of the following characteristics, as observed from analysis of seven pollutants for six cities over a three-year period:

(a) Concentrations are approximately lognormally distributed for all pollutants in all cities for all averaging times.

(b) The median concentration (50 percentile) is proportional to averaging time to an exponent.

If air quality data for the major cities are plotted on log-probability paper (for given averaging times), the resulting curves are nearly straight lines. This suggests that, to a good approximation, the distribution of samples follows a lognormal curve. The sketch below represents such a curve, with the logarithm of concentrations plotted on the horizontal axis and the number of samples obtained for each concentration (for a given averaging time) plotted on the vertical axis. The curve follows the familiar, bell-shaped probability distribution, the only difference being that the logarithm of concentration is plotted rather than the concentration itself. The center of such a curve falls not on the arithmetic-mean but on the geometric-mean (50-percentile) concentration. This is the concentration which divides equally the area under the curve: half of the samples will lie above this value and half will lie below it. As with the normal probability curve, the standard deviation is a measure of the "spread" of the curve. However, for the lognormal distribution, it is called the standard geometric deviation, and is the ratio of the concentration which is exceeded by 16% of the samples to that which is exceeded by 50% of the samples.



Since only two parameters are needed to define the shape of this distribution, it is possible, once these parameters are known, to calculate the concentration for any percentile. In addition, since a specified averaging period corresponds to a fixed number of samples over a year, the highest sample will correspond to a particular percentile. Thus, it is also possible to calculate the expected maximum concentration for the year. Equation (12) is a general relationship for calculating the concentration at any point along the curve as a function of the geometric-mean and standard-geometric deviation.

$$C = M_g (s_g)^z \qquad (12)$$

where:

C = concentration corresponding to the desired percentile and averaging time,

s_g = standard geometric deviation of samples (at the desired averaging time),

M_g = geometric mean of samples (at the desired averaging time),

z = plotting position which corresponds to the desired percentile.

The parameters M_g and s_g are obtained from the actual distribution of sample data, while z is the number of standard deviations on a normal probability curve that correspond to the desired percentile and may be obtained from statistical tables [c.f., Pearson and Hartley, 1966]. The table below shows the values of z for several selected percentiles. In the program the z values are obtained by an approximation technique which involves solving the normal, cumulative-probability density function:

$$P = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{+z} e^{-x^2/2}\, dx$$

Values of z For Various Frequencies

Highest Percentile	z
50.0%	0.00
30.0%	0.52
15.0%	1.04
10.0%	1.28
5.0%	1.64
1.0%	2.33
0.1%	3.09

Since a particular percentile is associated with the maximum concentration in any set of samples for a specified averaging time, a similar table may be prepared in which the values of z correspond to the maximum concentration for selected averaging times. Such values are listed below and, when used in Equation (12), they permit calculation of the expected maximum concentration in a distribution of samples (for a single averaging time) where M_g and s_g are known.

Values of x For Calculating the Maximum Concentration

Averaging Time	z
1 year	0.00
1 month	1.64
24 hours	2.94
8 hours	3.26
4 hours	3.46
2 hours	3.63
1 hour	3.81

The geometric mean for a given set of samples may be calculated from the arithmetic mean and the standard geometric deviation for that same set of samples in a relatively straightforward manner, as shown in Equation (13).

$$M_g = \chi/(s_g)^{(1/2 \ln s_g)} \qquad (13)$$

where:

χ = arithmetic mean

M_g = geometric mean for a set of samples

s_g = standard geometric deviation for the same set of samples

ln = the natural logarithm to the base e.

If s_g is for the desired averaging time, Equation (12) and Equation (13) may be used to provide the desired output. If the desired averaging time is different from that associated with the input s_g, then s_g must be translated to the desired averaging time. It is assumed that the input s_g corresponds to a 24-hour averaging time.

Larsen proposes a method to change averaging times by assuming that the median concentration is proportional to averaging time to an exponent. The standard geometric deviations for different averaging times may be related as shown in Equation (14).

$$s_{g_n} = (s_{g_{24}})^k \tag{14}$$

where:

$$k = \sqrt{\frac{\ln 8760/n}{\ln 8760/24}}$$

and

s_{g_n} = standard geometric deviation at averaging period of n hours

$s_{g_{24}}$ = standard geometric deviation of 24-hour samples

The statistical relationships described above, along with the annual arithmetic mean concentration computed by the diffusion model Equation (9), allow the user to estimate the expected maximum, geometric mean and various percentile pollutant concentrations at various averaging times.

4.4 TYPES OF OUTPUT

The types of output associated with each of the operational segments of the Atmospheric Diffusion Model are summarized in this section. Specific examples of output from the Atmospheric Diffusion Model are given in Section 8.2.

4.4.1 Calibration Results

If the calibration option of the model is exercised, the following two types of calibration data will be obtained.

(a) Correlation Data Table. For each pollutant type considered, the measuring station locations and input concentration levels for each season are tabulated. In addition, the theoretical concentration values (excluding background levels) calculated by the diffusion model at each measuring station location are shown.

(b) Regression Output Table. For each pollutant-season considered, the y-intercept and slope of the calibration line and the coefficient of correlation are tabulated. Also shown is the theoretical value (5 percent confidence level) expected for the correlation coefficient. If the calculated correlation coefficient is less than the theoretical value, the following note is printed: POOR CORRELATION COEFFICIENTS NOT USED.

If the regression constants are input, only the Regression Parameter Table will be output. In addition, the following note is printed: VALUES NOT COMPUTED

4.4.2 Generalized Receptor Output

(a) Receptor Concentration Table. For each pollutant-season combination considered, the total calibrated (if applicable) mean concentration values for each receptor will be output in tabular form.

(b) Receptor Concentration Card Deck. At the option of the user, the data contained in the Mean Concentration Table can be obtained as a punched card deck. The format of this deck is described in Section.

4.4.3 Analysis Data Output

For the annual period only, the following data may be obtained for each pollutant considered:

(a) Excess Table. This table displays those receptors (maximum of 50) at which the concentration levels exceed an input standard value. For each such receptor, the following information is given:

- Total Concentration - this is the same value as in the Mean Concentration Table.
- Excess Concentration - the amount by which the total concentration exceeds the input standard value.
- Concentration Level From Point Sources - the total point source contribution to the given receptor.
- Concentration Level From Area Sources - the total area source contribution to the given receptor.
- Point Source Reduction Required - this value gives the percent reduction of all point sources required to reduce the Excess Concentration to zero. A value greater than 100% indicates that the excess concentration cannot be eliminated by control of point sources alone.
- Source Reduction Required - this value gives the percent reduction of all sources required to reduce the excess concentration to zero.

(b) Source Contribution Table. This table presents the pollutant concentration contribution from each source and from the background concentration to five receptors. A note is printed with the table to indicate whether the five receptors have been selected by the user or represent the five highest-concentration receptors. The total concentration values at each of the five receptors (summation of the source and background values) are the same as in the Mean Concentration Table.

(c) Statistical Table. A table of statistical data for 12 selected receptors will be output for each selected averaging time (maximum of five). Each table is identified with respect to the pollutant being considered and the averaging time for which the data is applicable. The table includes the following information for each selected receptor:

- Mean Concentration values - these are the long-term concentration values given in the Mean Concentration Table and do not vary with averaging time.
- Expected Geometric Mean Concentration.
- Expected Maximum Concentration.
- Percentile Concentration - concentration values are given for three selected percentiles.
- Standard Geometric Deviation - the input Standard Geometric Deviation value for a 24-hour averaging time, converted to the selected averaging time.

4.4.4 Summary of Output Options

Several outputs are available to the user, including:

(a) print calibration results

(b) print values of input calibration constants

(c) print mean concentration values for all receptors

(d) punch card deck (for contour plotting) with mean concentration values for all receptors

(e) print statistical table

(f) print source contribution table for 5 maximum receptors

(g) print source contribution table for 5 selected receptors

These options are selected by control flags which are described in Chapter 8, Preparation of Input Data.

5.0 CONTROL COST MODEL

5.1 PURPOSE

The costs associated with air pollution control are of great importance to both the control official and the industrial plant manager. Economic as well as engineering factors affect the degree of air pollution control achievable, and accurate estimates of the overall impact of a pollution-reduction program will require relatively complete and detailed cost and engineering data. Sound air pollution planning must ensure that proposed programs are economically as well as technically feasible.

The Control Cost Model provides a computerized tool for generating cost and control effectiveness estimates for each point source within an air quality control region. These estimates can be used to evaluate the state of the art in control technology as it relates to each source or source category within the region. Cost information generated by the model is used in the Implementation Planning Program to evaluate the various emission control strategies available to the region. Both the degree of emission reduction and the total regional cost can thus be projected by the Control Strategies Model for a set of possible emission standards.

5.2 INPUT INFORMATION

The user must provide a number of input data elements to the Control Cost Model. The data required are of the type generally collected and used by air pollution control authorities and can be divided into three categories:

- o Regional Information
- o Emission Source Information
- o Control Device Information

A discussion of these categories is presented in the following sections. A more detailed description of the categories is given in Chapter 7, "Information Systems," while the specific format required by the computer program is shown in Chapter 8, "Preparation of Input Data."

As is the case with any simulation technique, the results obtained can be no better than the input data. Computation of accurate air pollution control costs is dependent upon utilization of accurate, complete emission inventories and current data on control devices, fuel costs, and many other parameters. Evaluation of control strategies requires a complete presentation of air pollution conditions within the region, and this presentation must be generated on the basis of high-quality input data. The importance of adequate inputs to the successful operation of the Control Cost Model cannot be overemphasized.

5.2.1 Regional Information

Certain of the input data used by the Control Cost Model will be specific to the particular air quality control region being considered. The use of a separate regional data specification permits identification of those items unique to the region. These items must be determined and stored in the data base for each regional analysis.

Some of the items included in the regional data base may vary somewhat from location to location within the control region. Such variations have been determined to be small in comparison to interregional differences, however. By removing these items from the description of each individual source, it was possible to reduce the total number of data inputs necessary.

The regional information required includes the following items:

(a) Labor Costs. The average hourly wage rate for unskilled labor within the region is used. The quantity of labor required depends on the characteristics of the emission source and the control device applied, but the cost of this labor is determined by the regional labor market.

(b) Sales Tax. This term affects the capital outlay for pollution control equipment. As many as three different sales tax rates can be specified for the major political jurisdictions which make up the control regions.

(c) Fuel Information. Each geographical area of the country represents an individual situation regarding fossil fuel usage and availability. Data on costs, sulfur and ash contents, and heating values must be collected for a variety of fuel types and grades. Information on fuels is required for the computations concerning fuel substitution control measures.

(d) Interest Rate. The prevailing interest rate should be specified. This item is used in computing an annualized cost based on the purchase and installation costs of control devices.

5.2.2 Source Information

Each individual pollution source* must be described in some detail. Data inputs are required so that applicable control devices may be identified. Calculation of control costs and efficiences requires specific information regarding the type and size of pollution source being considered. The following is a listing of the specific types of information required concerning each pollution source.

(a) Identification. Each source must be identified in several ways so that the results produced by the Cost Model and Strategies Model may be properly evaluated. A generic name (such as "Power Plant - Boiler" or "Grain Elevator") describing each source is used. The name facilitates examination of the output records by persons unfamiliar with the various coding schemes used with the program. The four-digit Standard Industrial Classification (SIC) code ** must also be supplied for each source. Many of the Control device selection routines are keyed to the SIC code identification. Each source is located by specifying, on the input record, its Universal Transverse Mercator (UTM) grid coordinates. The ownership is indicated as being either private or public (local, State, or Federal). The process type of each source, whether manufacturing, fuel combustion, or incineration, must also be specified. By means of these items of identification, it is possible to effectively apply both control measures and emission standards.

(b) Effluent Gas Stream. Complete specification of the exit gas stream conditions is necessary for atmospheric diffusion modeling. In addition, the type and size of control device applicable to a source are strongly affected by these parameters. Stack height, stack diameter, and stack velocity are all factors in the Atmospheric Diffusion Model. Because of the addition of certain control devices, these factors may be modified, and a recomputation of the Atmospheric Diffusion Model will be necessary as part of the Control Strategies Model. Stack temperature influences both the dispersion of pollutants (by affecting the effective stack height) and the cost and applicability of control devices. Considerably more expensive fabric-filter installations are required when high-temperature gas must be cleaned. Total effluent gas volume is the prime factor influencing the cost and size of possible pollution control devices.

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* Sources having insufficient emissions to be individually identified are geographically grouped together into area sources. Control efficiencies and costs cannot be calculated for area sources since detailed source characteristics are not available.

** SIC code classifications used in this program are listed in Section 8.1.

(c) Existing Pollution Controls. The type and efficiency of existing air pollution control devices are important factors in evaluating the air pollution status of an emission source. Additional control devices must be compatible with existing equipment, and their efficiencies must be adjusted to account for pollutant removal by the existing device. The existing control efficiency is also used to compute the plant's uncontrolled emissions, and these data are in turn required by certain control regulations applied in the Control Strategies Model.

(d) Operating Schedule. Both the daily and annual hours of plant operation are used in the computation of operating costs for various pollution control devices.

(e) Fuel Usage. For each combustion source the types, quantities, and grades of all fuels used must be supplied. These data form the basis for determining the applicability and effectiveness of various fuel substitutions. Also, the control efficiency achieved by certain of the control devices depends on the type of fuel burned by the pollution source. The existing pattern of fuel usage determines the allowable emissions under a number of emission standards.

(f) Process Rate. For industrial processes, the process rate is an important measure of plant capacity. Plant size determines the range of control measures available to a particular location and, under a number of control standards, the amount of emission permitted.

(g) Utility Costs. The cost of such items as electricity, fuels, and pollutant disposal strongly affects the cost of installing and operating control devices at particular sites. By having these items available for each source within the control region, it is possible to generate meaningful control cost estimates.

(h) Emission Rates. The actual amount of pollutant emitted by each source is, of course, a required input item. The emission rates for each pollutant of interest must be presented in three forms: summer average, winter average, and annual average. The seasonal averages permit air quality displays to be made over these averaging periods. The Control Cost Model provides control cost and effectiveness estimates only on an annual basis.

5.2.3 Control Device Information

A set of data is required concerning each control device whose application is simulated by the Control Cost Model. These data provide information on the control efficiency of the device as well as a basis for calculating costs when the device is applied to a particular pollution source.

Control device information (including non-device measures such as fuel substitution) is not handled in the same manner within the program as the regional and source data discussed above. The set of control devices available is essentially the same from region to region. Once the device information has been developed, it may thus be applied to the analysis of several air quality control regions. Only changes in control technology (such as the development of new or improved devices) or general economic changes should require modification of the control device information.

(a) Device Identification. As with the source records, a name is given for each control device (e.g., "Electrostatic Precipitator - High Efficiency"). This identification allows anyone familiar with air pollution control to recognize the type of control device mentioned in the model output. A three-digit numeric code is also assigned to each control device or measure. This code is utilized internally by the program. The more familiar device names and their respective numeric codes are given in the next section.

(b) Price Coefficients. The cost of each control measure to a particular source is determined by multiplying some measure of source size by these coefficients. Usually this measure of size is the number of cubic feet of gas per minute to be treated, but for some devices, the power-generating capacity, fuel usage, or some other measure is used. The exact use of the price coefficients in the Control Cost Model is presented in more detail in Section 3, Model Operations. The price coefficients for most devices were taken from the Control Technology Documents for Particulates and Sulfur Oxides published by the National Air Pollution Control Administration.

(c) Installation Cost Factors. These factors detail those other cost elements which must be considered, in addition to purchase price, in determining the total cost of installing a control device on a particular pollution source. Some of these factors depend mainly on characteristics of the source, while others relate more to the device itself. It is quite difficult to present these factors without reference to a particular source. However, it is possible to determine an overall quantity which represents the averaged sum of the individual factors. This data item is normally presented in the device specification and is used in computing the total installed cost of the device.

(d) Expected Life. The length of service expected from each control device is included in each device record. This item is used to apportion the total installed cost of the control device into an annual charge figure.

(e) Labor Quantity. The amount of labor necessary to operate and maintain each device is an input data element. Labor quantities associated with four different device sizes are presented, and the appropriate one for each particular emission source is selected and applied within the Control Cost Model. Labor expense is one of the major components of device operating and maintenance costs.

(f) Operating Cost Factors. A number of factors relating to each device are considered in the computation of operating cost. The pressure drop associated with each device measures the resistance to gas flow through the device and thus the amount of power necessary to operate it. Chemical costs give the relative costs of additives used in wet scrubbing when gases in the effluent stream are reacted. If the control device uses fuel, a factor must be included which corrects the amount of fuel used to account for the use of heat exchangers or catalytic combustion.

(g) Disposal Cost or Credit. For each pollutant collected, there must be a charge for its disposal. This charge is associated with the control device, since the form in which the pollutant is collected is quite important. If the collected pollutant has value, either directly or by return to a process, then the disposal charge will be negative relative to the other device costs.

(h) Rated Efficiency. These data elements represent the basic removal efficiencies of the control device under consideration for the various pollutants. These efficiencies are modified within the Control Cost Program to reflect variations in source characteristics. The modifications are made on the basis of pre-programmed engineering criteria which take into consideration both the emission characteristics of particular sources and the effect of existing control devices.

The control devices currently available are shown in Table 5-1. This table also indicates the numeric device code used in the Implementation Planning Program.

TABLE 5-1. POLLUTION REDUCTION DEVICES OR METHODS

001	Wet Scrubber - High Efficiency
002	Wet Scrubber - Medium Efficiency
003	Wet Scrubber - Low Efficiency
004	Gravity Collector - High Efficiency
005	Gravity Collector - Medium Efficiency
006	Gravity Collector - Low Efficiency
007	Centrifugal Collector - High Efficiency
008	Centrifugal Collector - Medium Efficiency
009	Centrifugal Collector - Low Efficiency
010	Electrostatic Precipitator - High Efficiency
011	Electrostatic Precipitator - Medium Efficiency
012	Electrostatic Precipitator - Low Efficiency
013	Gas Scrubber
014	Mist Eliminator - High Velocity
015	Mist Eliminator - Low Velocity
016	Fabric Filter - High Temperature
017	Fabric Filter - Medium Temperature
018	Fabric Filter - Low Temperature
019	Catalytic Afterburner
020	Catalytic Afterburner with Heat Exchanger
021	Direct Flame Afterburner
022	Direct Flame Afterburner with Heat Exchanger
027	Fuel Substitution to 2% Sulfur Coal
028	Fuel Substitution to 1% Sulfur Coal
029	Fuel Substitution to 0.5% Sulfur Coal
030	Fuel Substitution to 2% Sulfur Oil
031	Fuel Substitution to 1% Sulfur Oil
032	Fuel Substitution to 0.5% Sulfur Oil
033	Fuel Substitution to Natural Gas
039	Catalytic Oxidation - Flue Gas Desulfurization
040	Alkalized Alumina
041	Dry Limestone Injection
042	Wet Limestone Injection
043	Sulfuric Acid Plant - Contact Process
044	Sulfuric Acid Plant - Double Contact Process
045	Sulfur Plant

5.3 CONTROL MEASURES

Brief descriptions of the various control devices are given in the following section. Most control devices are designed to remove a particular pollutant but, as noted, some devices or control measures may simultaneously reduce emissions of two or more pollutants.

(a) Wet Scrubbers or Wet Collectors (Device Code, 01, 02, 03) are devices which use a liquid, commonly water, to either remove particulates or gases directly from a gas stream by contact, or to increase the collection efficiency of a second-stage collector by increasing the effective particle diameter. The simplest wet scrubber is a spray chamber into which water is injected by a spray nozzle device. Wet scrubbers applied to a hot gas stream have the additional propriety of gas cooling and humidification.

(b) Mechanical Collectors are devices which remove particulate matter from a gas stream by using only the force of gravity or centrifugal force. Nothing is injected into the gas to combine with or entrain the particles. The two principal types of mechanical collectors are:

(1) Gravity Collectors (04, 05, 06), which are chambers where the gas flow is slowed down sufficiently for large particles to settle out. Gravity collectors are typically very low in efficiency except for relatively large particles, and they require considerable space.

(2) Centrifugal Collectors or Cyclones (07, 08, 09), which use the centrifugal force created by a spinning gas stream to drive particulate matter from the gas. The spinning gas stream is set up inside a cylindrical container by tangential gas inlets, vanes, or fan action.

(c) Electrostatic Precipitators (10, 11, 12) are devices which remove particles from a gas stream by electrically charging the suspended particles as the gas passes through a corona discharge and collecting the charged particles on a grounded collection plate. High-voltage precipitators can be operated over a relatively wide range of collection efficiencies. Due to the low pressure drop, these devices have low operating costs for large gas volumes.

(d) Gas Scrubber (13). The cost elements of this device were expressly tailored to gas rather than mist or particulate removal.

(e) Mist Eliminators (14, 15) are devices designed to remove and collect liquid droplets. The principal collection mechanisms are interception and impaction. Operation is much like that of fabric filters for dry particulates.

(f) Fabric Filters (16, 17, 18) remove particles from a gas stream by passing the gas through fabric tubes or envelopes. A cake of collected particles, supported by the fabric, accomplishes the filtration. Very high efficiencies can be attained using fabric filters. A wide range of fabrics and cleaning techniques is available.

(g) Afterburners (19, 20, 21, 22) are devices which remove both gaseous and particulate pollutants by combustion. The direct-flame afterburner brings the gas stream into contact with a high-temperature flame to achieve rapid oxidation. The catalytic afterburner operates at a lower temperature by oxidizing the gas stream on the surface of a catalyst.

(h) Fuel Substitution (27-33) control measures involve switching from a high-sulfur-content fuel to one with a lower sulfur content. The Control Cost Model examines the costs of switching from coal or oil to coal, oil or gas of varying sulfur contents. Emissions of sulfur oxides, particulates, and carbon monoxide are affected by fuel changes. Many other parameters also influence emissions of the last two pollutants, including combustor design, excess air, temperatures, etc.

(i) Flue Gas Desulfurization methods rely upon injection into the exit gas stream of various chemicals (alternatively, the reactive or catalytic material may be employed in a fixed or fluidized bed) which either react with sulfur oxide directly to produce a readily collectible solid or gas or absorb the sulfur oxide by producing a physically bonded sulfate. The more promising methods for cleaning flue gases are:

(1) Catalytic Oxidation (39) of the sulfur dioxide in the flue gas is a recently developed desulfurization process. After high-temperature oxidation of the SO_2 to SO_3, an absorbing tower procedure using sulfuric acid is employed. Sulfur is recovered as commercially saleable sulfuric acid. This process is reported to be applicable to larger existing installations and to new power generating stations [Stites, 1969].

(2) The Alkalized Alumina Process (40) which employs activated sodium aluminate to react with sulfur oxide to produce sodium sulfate. The sodium aluminate is regenerated in the process by heating in the presence of reducing gases. This regeneration process produces hydrogen sulfide, which then is converted to elemental sulfur by a conventional Claus-type reaction.

Due to the lack of data from large-size prototype units, economic data for this process are very speculative at this time and must be based on the Bureau of Mines estimates (McCrea, 1968; Katell, 1967), which cover only an 800-MW size coal-fired plant and indicate approximately 90 percent removal of sulfur oxides. However, the alkalized alumina process is not applicable to older existing plants because of the many changes which must be made to the flue gas duct and heat recovery systems. Large new plants constructed during the early to middle 1970's will be prime candidates for this system when it is perfected.

(3) The Limestone Injection - Dry Process (41), which employs finely ground limestone injected into the boiler combustion zone to form calcium sulfate. The sulfate is then removed from the gas stream by a precipitator or other particulate control device.

(4) The Limestone Injection - Wet Process (42), which employs the same basic injection of limestone as the dry process, but instead of collecting calcium sulfate in the dry state, a liquid slurry of lime is used to remove the sulfate and any unreacted sulfur oxide.

(j) By-Product Manufacturing (43-45) facilities co-located with the emission source can use a sulfur-bearing gas stream to control sulfur oxide emission. Either elemental sulfur or sulfuric acid may be manufactured from a sulfur-oxide-rich gas. Both products are in relatively high demand in industrial markets, and often can bring a price high enough to substantially offset the cost of controlling emissions. Cases in which sulfuric acid and sulfur plants are used as control measures are not to be confused with cases where similar plants are operated independently in such a manner as to be emission sources themselves. Clearly, a sulfur plant will not be considered a control measure for a sulfur plant emission source.

5.4 MODEL OPERATIONS

Three basic functions are performed by the model on each source within an air quality control region.

(a) Applicable control devices and/or non-device control measures are assigned to each point source within the region.

(b) The expected pollution reduction efficiency is determined for each source-device combination.

(c) The capital charges and maintenance expense are estimated for each control device.

These steps, described in more detail below, permit investigation of both overall and detailed pollution control costs. Additionally, comparisons of costs versus effectivness can be made for the various source-device combinations examined.

5.4.1 Assignment of Control Devices

The applicability of a control device to a particular source depends upon a large number of engineering factors related to both the source and device characteristics. Within the Control Cost Model, device assignment is performed in two basic steps which produce a list of potential pollution control devices for each source within the air quality control region. As will be seen in Section 5.4.2, certain of the devices in this list will produce collection efficiencies too low to be useful. The final list of control devices actually simulated for each source includes only those devices remaining after the criteria described in both this section and Section 5.4.2 are applied.

A table has been prepared (Table 5-2) which indicates all potentially applicable control devices for each type of pollutant emitter identified in an air quality control region. This table also indicates a particulate collection efficiency correction factor which is based on the emission characteristics (particle size, density, etc.) and is used in the following section.

The industrial definition is basically the four-digit Standard Industrial Classification code. An added digit is used when necessary to specify the particular process causing the emissions. The basic references used to match control devices to industrial process types were the National Air Pollution Control Administration's Control Technology documents. The relationships shown in Table 5-2 are standard program inputs and are not restricted to any particular region. If a pollution source is identified whose industrial classification is not included in the tabulation, the program user is required to generate the appropriate source-device applicapability data. This data is then added to the input record. Any type of pollution source maybe handled by extending Table 5-2 to include it. Exact instructions for presenting additions of this type to the computer are given in Chapter 8 .

Table 5-2 Applicable Control Devices

SOURCE TYPE	CONTROL DEVICE TYPE																																			
	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	27	28	29	30	31	32	33	39	40	41	42	43	44	45
COMBUSTION							O	O	O	O	O	O				O	O	O					O	O	O	O	O	O	O	O	O	O	O			
SIC 2040							-5	-5	-5							O	O	O																		
SIC 2819 nnn1													O	O	O																					
SIC 2819 nnn2	O	O	O											O																						
SIC 2819 nnn3	O	O	O																																	
SIC 2822																O	O	O																		
SIC 2851		O	O																O	O	O	O														
SIC 2871										O	O	O				O	O	O																		
SIC 3210	-5	-5	-5													O	O	O																		
SIC 3241							-5	-5	-5	O	O	O				O	O	O																		
SIC 2951	O	O	O				O	O	O							O	O	O																		
SIC 3250	O	O	O				O	O	O							O	O	O																		
SIC 3295	-2	O	O				O	O	O							O	O	O																		
SIC 3312 nnn1	O									O	O																									
SIC 3312 nnn2	O									O	O																									
SIC 3312 nnn3							O	O	O	-3	-3	-3																								
SIC 3312 nnn4																																				
SIC 3312 nnn5	O									O	O					O	O	O																		
SIC 3312 nnn6	O									O	O					O	O	O																		
SIC 3323	O	O	O				-6	-6	-6							O	O	O																		
SIC 3332 nnn1										O	O	O	O																					O	O	O
SIC 3332 nnn2										O	O	O																								
SIC 3332 nnn3										O	O	O	O																					O	O	O
SIC 4953	-1	-1	-1				-2	-2	-2																											
SIC 2911							O	O		O	O																									
SIC 2800													O																							

Table 5-2 represents an inclusive list of control devices which may be applied to a particular source category. Any particular source within this category may have characteristics which prevent the application of certain of the devices. This problem is taken up in the next section. The portion of the Control Cost Model described in Table 5-2 merely determines a list of potentially applicable devices for each source type from the total number of control devices available.

Once a list of devices applicable to the particular type of pollution source has been formulated, specific characteristics of the source must be considered. Each control device category has certain operating requirements which must be compatible with the source parameters described in Section 5.2 of this chapter, as follows:

(a) Wet Scrubbers (01, 02, 03)

No specific restrictions are placed on the application of these devices on the basis of source parameters.

(b) Gravity Collectors (04, 05, 06)

These devices do not achieve high enough collections to meet current air pollution control levels and will not be utilized with the Implementation Planning Program. They are included mainly for completeness, and specific device applicability criteria are not presented.

(c) Cyclone Collectors (07, 08, 09)

Cyclone collectors are not applicable to the control of particulate emissions from fuel combustion sources burning predominately oil or gas. There are no other restrictions on the application of these devices consistent with Table 5-2.

(d) Electrostatic Precipitators (10, 11, 12)

If oil or gas is the major fuel of a combustion source (see above), then only the high-efficiency device (10) should be used and the applied efficiency should be 75 percent.

(e) Gas Scrubber (13)

No specific source parameters affect the application of this device.

(f) Mist Collector (14, 15)

These devices are applicable at their rated efficiency to each source to which they are applied, Table 5-20. If a mist collector is already installed, then only the 14 device should be applied and its applied efficiency will be 90 percent.

(g) Baghouse (16, 17, 18)

Only one of these devices is applicable to any source, i.e., if a 17 is applied, then the 16 and 18 will not be used. The following criteria have been programmed for this device category:

(1) These devices are not applicable if the existing device is a 01, 02, 03, or 13.

(2) If exit temperature is less than or equal to 180°F (355°K), use device 18.

(3) If exit temperature is more than 355°K but less than or equal to 394°K, use device 17.

(4) If exit temperature is more than 394°K, use device 16.

(h) Afterburners (19, 20, 21, 22)

These devices should be applicable to each source specified in Table 5-2.

(i) Fuel Substitutions (27-33)

The program attempts each fuel substitution on every combustion source. Those substitutions producing a reduced sulfur oxide emission are classed as acceptable and are included in the output records.

(j) Flue Gas Desulfurization (39, 40, 41, 42)

The following conditions must exist before a flue gas desulfurization process can be applied:

(1) The source must be a power plant (SIC 4911).

(2) The source must emit more than 20 tons/day of SO_2.

(3) If the source uses more than 40 percent coal (calculated on a usable heat energy basis), then use 39, 40, 41, and 42.

(4) If the source uses less than 40 percent coal (usable heat energy), then use 39 and 40.

(k) Sulfuric Acid - Sulfur Plants (43, 44, 45)

These control measures should be applied as specified in Table 5-2 when the source's emissions are greater than 20 tons/day of SO_2.

5.4.2 Collection Efficiency Rating

The basic pollutant collection efficiency of each device must be adjusted to account for the particular characteristics of the source to which it has been applied. All of the efficiency corrections described in this section relate to the particulate collection efficiency; sulfur oxide and carbon monoxide removal are calculated on the basis of the unadjusted rated efficiencies.

The first efficiency adjustment was presented in Table 5-2. The number indicating a device's applicability to a particular industrial source category is also used as a percentage efficiency correction. For instance, the listing for SIC 4953, incinerators, indicates that wet scrubbers (devices 01, 02, 03) and electrostatic precipitators (10, 11, 12) are applicable devices. The minus-one (-1) shown under the wet scrubber headings indicates that the rated particulate collection efficiency must be reduced by one percent on this source type (i.e., one percent is subtracted from the rated efficiency). Similarly, precipitators lose two percent of their rated efficiency. This correction takes into account the relative collection difficulty over a variety of source classifications.

In addition to the above correction based on source type, certain characteristics peculiar to particular sources require modifications in a device's collection efficiency. The most important of these factors is the existence of a collection device on the source previous to the application of another device. If a high degree of particulate removal has already been achieved, additional collection is quite difficult. Accordingly, Table 5-3 has been created and programmed onto the Control Cost Model. Efficiency corrections for the three most widely used types of particulate collectors are calculated on this basis (wet scrubbers 01, 02, 03; dry cyclones 07, 08, 09; electrostatic precipitators 10, 11, 12). An example of this efficiency correction is as follows:

TABLE 5-3. EXISTING DEVICE CORRECTION FACTORS

Existing Efficiency	Wet Collector Factor	Cyclone Factor	Electrostatic Precipitator Factor
> 0 and ≤40	1.0	1.0	1.0
>40 and ≤60	1.1	1.3	1.0
>60 and ≤65	1.2	1.8	1.1
>65 and ≤70	1.3	2.3	1.2
>70 and ≤75	1.5	2.7	1.3
>75 and ≤80	1.8	3.2	1.6
>80 and ≤83	2.2	3.8	2.0
>83 and ≤86	2.6	4.4	2.5
>86 and ≤89	3.1	5.1	2.9
>89 and ≤91	3.5	5.8	3.4
>91 and ≤93	4.1	6.6	3.9
>93 and ≤95	4.7	7.6	4.4
>95 and ≤97	5.5	9.0	5.4
>97 and ≤99	7.3	11.0	7.5
>99 and ≤100	10.0	12.0	11.0

After the correction factor has been determined for any of the above device classifications, the actual applied efficiency is calculated by means of the following equation:

$$\text{Applied Eff.} = 1.- (1. - \text{Rated Eff.}) \times \text{Correction Factor}$$

Applied Efficiency and Rated Efficiency are decimal fractions. The rated efficiency is given in the device record for each control device.

A high-efficiency electrostatic precipitator (10) is applied to a source already employing a 90 percent-efficiency particulate collection system. According to Table 5-3, a factor of 2.9 should be used; the actual applied efficiency will be:

$$\text{Applied efficiency} = 1 - (.01) \times 3.4 = .966$$

$$= 96.6\% \text{ instead of the rated } 99\%$$

This correction is applied before the general source-type correction described in the previous paragraph.

Should the effect of these corrections be to reduce a device's applied particulate collection efficiency below 30 percent, then that source-device combination is rated not acceptable and is not included in the output records. Only after a device has been rated acceptable for a specific source according to criteria presented in this and the previous section are the cost calculations carried out.

5.4.3 Purchase and Installed Cost Calculations

After the set of applicable control devices has been determined for each pollution source, the costs associated with applying and operating each device are calculated. The device costs can be divided into two categories, purchase-installation cost and operating and maintenance cost.

The purchase cost of control devices depends, in general, upon two factors, the characteristics and complexity of the control device, and the size of the pollution source to be controlled. In the Control Cost Model, these factors are used to determine a basic purchase cost equation for each control device. The general form of this equation is:

$$y = a + bx + cx^2,$$

where y = purchase cost in thousands of dollars, and a, b, and c are input coefficients in the device specification.* Table 5-4 displays the coefficients associated with each control device. The variable x represents some measure of the source's size. The precise measure used for each control device is described in the following paragraphs.

(a) Devices 01, 02, 03, 13

X is exhaust gas volume in thousands of ACFM. Since a temperature change occurs in these wet collection devices,

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* In most cases a linear equation ($y=ax+b$) was found to be sufficient.

Table 5-4. MANUFACTURER'S PRICE

(Cost Functions $Y = \text{Dollars} \times 10^3$, $X = \text{ACFM} \times 10^3$)

CONTROL MEASURE	LINEAR FUNCTION
Wet Collector	
High Efficiency	$y = 2.886 + .228x$
Medium Efficiency	
Low Efficiency	$y = 1.257 + .145x$
Mechanical Collectors	
Gravity Collectors	
High Efficiency	$y = -.445 + .326x$
Medium Efficiency	$y = -.042 + .155x$
Low Frequency	$y = .003 + .056x$
Centrifugal Collectors	
High Efficiency	$y = 2.413 + .197x$
Medium Efficiency	$y = 1.507 + .157x$
Low Efficiency	$y = .244 + .099x$
Electrostatic Precipitators	
High Voltage	
High Efficiency	$y = 42.413 + .623x$
Medium Efficiency	$y = 31.243 + .441x$
Low Efficiency	$y = 19.695 + .318x$
Low Voltage	
High Efficiency	$y = 4.030 + 1.312x$
Medium Efficiency	$y = 3.599 + 1.140x$
Low Efficiency	$y = 3.219 + .968x$
Fabric Filters	
Type "A"	$y = 1.448 + .838x$
Type "B"	$y = 3.478 + .448x$
Type "C"	$y = 2.658 + .325x$

Table 5-4. MANUFACTURER'S PRICE (continued)
(Cost Functions $Y = \text{Dollars} \times 10^3$, $X = \text{ACFM} \times 10^3$) (Continued)

CONTROL MEASURE	LINEAR FUNCTION
Gas Scrubber	$y = 3.175 + .251x$
Mist Eliminator	
High Velocity	$y = 2.658 + .325x$
Low Velocity	$y = 1.772 + .217x$
Increased Combustion Efficiency	
Catalytic Combustion	$y = 7.550 + 1.515x$
Catalytic With Heat Exchange(1)	$y = 7.550 + 1.515x$
Direct Flame Combustion	$y = 5.713 + 1.174x$
Direct Flame With Heat Exchange(1)	$y = 5.713 + 1.174x$
Fuel Substitution(2)	
Flue Gas Desulfurization(3)	
Catalytic Oxidation	$\log y = -12.412 + 1.67 \log x$
Alkalized Alumina	$y = 21.6 \times 10^{-7} x + 2.6 \times 10^{-17} x^2$
Limestone Injection (dry)	$y = 9.95 \times 10^{-7} x + 6.03 \times 10^{-17} x^2$
Limestone Injection (wet)	$y = 14.35 \times 10^{-7} x + 5.2 \times 10^{-17} x^2$
By-Product Manufacture(4)	
Sulfuric Acid Plant (Contact Process)	$y = a + .80x$
Sulfuric Acid Plant (Double Contact)	$y = a + .80x$
Sulfur Plant	$y = a + .81x$

Notes: (1) Fuel substitution cannot be represented by a simple formula. A complete explanation of the procedure used to compute the cost of fuel substitution is found in Section 5.3.

(2) Heat exchangers are considered accessory equipment and their costs are included under installation costs.

(3) The "x" terms in the equations should be at the rated capacity of the source (BTU/Hr).

(4) By-product manufacture involves the construction of a separate facility at the pollution source site. Manufacturer's price cannot be stated for such a facility. These equations therefore represent the installed cost of these control measures. The "x" variable is percent by weight of SO_2 in the exhaust gas. The "a" coefficient is defined in the Control Cost Model.

a new exhaust volume based on the original gas volume must be computed.

$$T_n = 294 + .097\,(T_o - 294) \qquad \text{(devices 01, 02, 03, 13)}$$

where T_n = new exit temperature (°k)

T_o = exit temperature as input (°k)

then

$$C_n = C_o\,T_n/T_o \qquad \text{(devices 01, 02, 03, 13)}$$

where C_n = new exhaust gas volume (ACFM)

C_o = exhaust gas volume as input (ACFM)

$X = C_n$ for devices 01, 02, 03, 13.

When the exhaust gas volume is changed, the exit conditions are also affected. It will be assumed that the same linear discharge velocity is maintained, and the stack exit diameter must thus be adjusted. The exit diameter after application of one of the above devices is calculated by the following equation:

$$D_n = D_o \sqrt{C_n/C_o}$$

where D_n = new exit diameter (m)

D_o = old exit diameter (m)

C_n = new exhaust gas volume (ACFM)

C_o = old exhaust gas volume (ACFM)

(b) Devices 04 - 12 and 14 - 18

X is exhaust gas volume in thousands of ACFM as input in the source file, with no corrections applied.

(c) Devices 19 - 22

The coefficient in the purchase price equations is the actual exhaust gas emission rate. As these devices (afterburners) do produce a change in the exit temperature, adjustments must be made. The following calculations do not affect the cost of these devices but are necessary to properly carry out the atmospheric modelling task. The new exit temperature (T_n) is computed as follows:

$T_n = T_o + t$

where T_o = existing exit temperature (°K)

t = 288 for device 19
139 for device 20
556 for device 21
222 for device 22

Assuming that the same exit velocity is maintained after the control devices, this temperature change requires the adjustments of C_n and D_n in Sec. 5.4.3a.

(d) Device 39

X is the logarithm of the generating capacity of the plant (Mw), and y is the logarithm of the purchase cost ($\$ \times 10^3$).

(e) Devices 40 - 42

X is the rated generating capacity of the plant (Mw). This value can be used directly as input to the source file.

(f) Devices 43 - 45

X is the logarithm of the amount of sulfur in the exhaust gas in tons/day, calculated as follows:

$S = E_s/2$

where S = amount of sulfur in exhaust gas (tons/day)

E_s = annual SO_2 emission rate as input (tons/day)

X = log S for devices 43 - 45.

Also, for these devices "a" is the input as a price coefficient, determined on the basis of the device and the percent by volume of SO_2 in the exhaust gas. This percent is calculated using the following formula:

$P = 68.5\ E_s\ T/V$,

where E_s = annual SO_2 emission rate as input (tons/day)

T = exit temperature as input (°K)

V = exhaust gas volume as input (ACFM)

P = % SO_2 by volume

The quantity "a" (to be used in the cost equation) is determined as follows:

	Device 43	Device 44
$0 \le P \le 3.0$	$a = -0.8218$.	$a = -0.7426$
$3.0 \le P \le 6.0$	$a = -1.0647$	$a = -0.9855$
$6.0 \le P \le 10.0$	$a = -1.2937$	$a = -1.2145$
$P \ge 10.0$	$a = -1.3449$	$a = -1.2657$

	Device 45
$0 \le P \le 5.0$	$a = -0.5779$
$5.0 \le P \le 7.0$	$a = -0.7069$
$P \ge 7.0$	$a = -0.7629$

The "y" value which the cost equation gives is not the purchase cost in thousands of dollars as it is for most devices; it is instead the logarithm of the purchase cost in millions of dollars.

In summary, for devices 43, 44, and 45, the cost equation is:

$$y = a + bx$$

where y = logarithm of purchase cost (\$ x 10^6)

a = number determined by device type and percent SO_2 in exhaust gas.

b = number input to the computer in the device files as Manufacturer's Price Coefficient #2.

x = logarithm of the amount of sulfur in the exhaust gas (tons/day).

When a corrosive gas stream must be handled, more expensive construction materials must be used in any control devices applied. In the Control Cost Model, a factor which increases the device purchase price is applied when acid manufacturing facilities are controlled.

If exit temperature < 330, multiply purchase cost by 1.7.
If exit temperature > 330, multiply purchase cost by 5.0.

Installation Cost. The cost of installing a control device on a particular source is calculated on the basis of an installation cost factor. This factor is expressed as a percentage of the purchase price and is an input item for each control device. The purchase cost and installation charge are summed to determine the total installation cost of each source-device combination.

Some of the control devices require quite extensive modification of the source, and it is not possible to identify a purchase cost figure independent of the installation charge. For these devices, the total installed cost rather than the purchase price is estimated by the equations described above. No additional factor is required in these cases to account for installation at a source site. Devices in this category are the flue gas desulfurization units (39, 40, 41, 42) and by-product manufacturing facilities (43, 44, 45).

Annual Capital Charge. After the total installed cost of a device has been determined, an annualized capital charge is calculated, based on the rated life of the control device and the prevailing interest rate (regional specification). The total yearly cost to the source for controlling pollution by means of a specified device is then the sum of the annual capital charge and the annualized operating and maintenance expense discussed in the next section.

5.4.4 Operating and Maintenance Expense

Operating and maintenance (O&M) expenses are usually a major factor in the annualized control device cost. The computations of the cost for each type of control device present in the data base are described below.

A number of factors must be considered in determining the O&M cost of a particular source-device combination: The amount of power (calculated as electrical power) necessary to force the effluent gas stream through the control device, the quantity of labor required, the cost of liquid or additional fuel used by the device, and the cost or credit resulting from disposal of the collected pollutant. These factors are used in the following equations.

For control devices 01 through 22, a single equation is used to compute the annual O&M cost.

$$O\&M = AB + CD + EF + GI + JK + LM$$

Where A = electricity quantity (kwhr/yr)	(a)*
B = electricity cost ($/kwhr)	(source file)
C = liquid quantity (gal/yr)	(b)
D = liquid cost ($/gal)	(source file)
E = chemical quantity (T/yr)	(c)
F = chemical cost ($/ton)	(device file)
G = fuel quantity (cu.ft./yr)	(d)
I = fuel cost ($/cu. ft.)	(natural gas cost regional file).
J = disposal quantity (T/yr)**	(e)
K = disposal cost ($/ton)	(f)
L = labor quantity (hr/yr)	(g)
M = labor cost ($/hr)	(regional file)

* The letters refer to the following paragraphs which describe the computation of these data elements.

** The quantity JK must be computed and added to the O&M equation for each pollutant.

(a) Electricity Quantity (kw/hr/yr) = $(1.955 \times 10^{-4})pVH$

where p = pressure drop (in H_2O)

V = exhaust gas volume (ACFM) this should be the new computed volume in the case of a wet device (see Section 3.3.1).

H = operating hours (hr/yr)

If the device is one of the electrostatic precipitators (#10, 11, 12), add the following quantities to the electricity quantity:

Device 10 add (0.34×10^{-3}) VH

Device 11 add (0.26×10^{-3}) VH

Device 12 add (0.19×10^{-3}) VH

(b) Liquid Quantity (gal/yr) = (3.0×10^{-2}) VH

Liquid Quantity is only computed for wet devices (01, 02, 03, 13), and the exhaust gas volume (V) will always be the new computed volume. (See Section 5.4.3).

(c) Chemical Quantity (T/yr) = $P_s H$

Where P_s = amount of SO_2 removed by the device.

(d) Fuel Quantity = V x factor x H

Where factor = 0.490 if device = 019
0.245 if device = 020
1.000 if device = 021
0.404 if device = 022
0.000 all other devices

It should be noted that additional fuel is only used for the catalytic and direct flame afterburners.

(e) Disposal Quantity = Emission rate for pollutant in question x new device efficiency for same pollutant x 365.

This must be computed for each of the pollutants.

(f) Disposal Cost = Disposal factor (source file) + disposal cost or credit (device file).

This must also be done for each pollutant.

(g) Labor Quantity = L x H

Where H = operating time (hr/yr)
L = labor (hr labor/hr operation)

In the device data specification there are four labor figures given: small, medium, large, and extra large. The labor figures relate to the source size being controlled. Source size is measured by V, actual cubic feet of exhaust gas per minute.

Use the small figure for	$V \leq 40,000$
Use the medium figure for	$40,000 < V \leq 250,000$
Use the large figure for	$250,000 < V \leq 1,000,000$
Use the extra large figure for	$V > 1,000,000$

For any particular control device, only some of the terms in the above equation will be non-zero. An electrostatic precipitator, for instance, will use no liquid, chemicals, or additional fuel.

Operating and maintenance costs for the remaining control devices cannot be estimated by the above calculations. These devices are generally more complex (involving sulfur oxide removal), and separate equations have been developed to compute their O&M expenses. These equations are based on manufacturers' specifications and operating experience reported in the literature.

For the four flue gas desulfurization measures considered, the following calculations of operating cost are used.

Device 39 - Catalytic Oxidation

$$O\&M = 0.05 \text{ (total installed cost)} + AB + JK$$

Where A, B, J, and K are as defined above.

Device 41 - Dry Limestone

$$O\&M = 356\, P_c(0.17 + 7.0\, SC_c) + 25{,}000$$

Device 40 - Alkalized Alumina

$$O\&M = 438\, (P_c + P_o/250)$$

Device 42 - Wet Limestone

$$O\&M = 365\, P_c\, (0.196 + 3.82\, SC_c) + 130{,}000$$

In the three above equations:

P_c = annual coal process rate (T/day)

P_o = annual oil process rate (gal/day)

S = sulfur content of original coal

C_c = chemical cost ($/ton)

The O&M costs associated with the use of by-product manufacture (sulfuric acid or sulfur) as a pollution control measure are computed as follows. The variable P used in these computations is the percentage, by volume, concentration of sulfur dioxide in the exhaust gas. The computation of P is given in Section 5.4.3, where the purchase costs for these control measures are described.

Devices 43, 44 - H_2SO_4 Plant - Single Contact and Double Contact Process

$\log y = 0.75 \log x + a$

where y = annual O&M cost ($\$ \times 10^3$)

x = sulfur emission in T/day (see page 9)

if	0	$P < 3.0$	$a = 1.6903$
	3.0	$P < 6.0$	$a = 1.4445$
	6.0	$P < 10.0$	$a = 1.2076$
		$P > 10.0$	$a = 1.721$

Device 45 - Sulfur Plant

$\log y = 0.81 \log x + a$

where y = annual O&M cost ($\$ \times 10^6$)

x = sulfur emission (above)

if	0	$P < 5.0$	$a = -1.210$
	5.0	$P < 7.0$	$a = 1.375$
		$P > 7.0$	$a = 1.435$

$$\text{O\&M} = y + JK - \frac{\text{Purchase Cost}}{\text{Life}}$$

where Purchase Cost is as defined in Section 5.4.3(e) and Life is the rated life of the control device. Purchase cost enters the O&M equation since the determination of y already includes the depreciation allowance.

5.4.5 Fuel Substitution

The principal cost of any fuel substitution is the increased operating cost due to the use of more expensive fuel. The step-by-step procedure used to calculate the costs and control efficiencies resulting from the fuel substitutions is detailed below:

(a) Determine the type of fuel being burned and its sulfur content for each combustion source under consideration. If a source is burning more than one fuel type or significantly different varieties of the same type, obtain the above data for each type.

(b) Compute the annual Potential Heat Energy Output of each fuel burned by the source.

$$\text{PHEO}_{(M)} = \text{Heat content}_{(M)} \times \text{Process Rate}_{(M)} \times \frac{\text{Annual Operating Hours}}{8 \times \text{shifts}}$$

where M is an identifier for fuel type. All variables in this equation are contained in the data files (Chapter 7).

(c) Compute the actual heat energy output of each fuel burned by the source. This is given as the product of the boiler efficiency and the potential heat energy output. Boiler efficiencies vary with the type of fuel burned and the level of BTU output of the boiler. The following table of efficiencies is contained in the data files.

	Coal	Oil	Gas
BTU Output Greater Than $.1 \times 10^9$	.87	.86	.82
BTU Output Less Than $.1 \times 10^9$	.75	.77	.80

Since the total BTU output of the source is not known *a priori*, the program initially assumes it to be greater than $.1 \times 10^9$, calls the appropriate efficiency from the data system, and multiplies it by the results of (b) above. A test is then performed to see if, in fact, the output is greater than $.1 \times 10^9$. If it is not, the second efficiency is called from the data system and used in the multiplication. If it is known that a particular emission source burns more than one type of fuel in the same boiler, the above efficiencies do not apply. In this case, a weighted efficiency is computed, based on the proportions of each fuel input to the process. After multiplication by the weighted efficiency, the BTU output check is also performed as detailed above.

(d) Sum the actual BTU output from each of the M fuel types burned by the source. This BTU output must be maintained after the fuel substitution has been made.

(e) Each of the seven substitute fuels defined in the data base is then selected as a possible alternative to the original fuel usage.

(f) The total annual cost of operating with the selected alternate fuel is computed by first determining the quantity of alternate fuel required to maintain the total BTU output and multiplying this by the cost per unit. The quantity of alternate fuel is found by substituting the new heat content and efficiency (if applicable) in the equation for actual heat energy output and solving for quantity of fuel. The total cost of operating with the original fuel is computed as the product of quantity and cost. The two fuel cost figures are subtracted to arrive at the incremental fuel cost.

(g) The new sulfur oxide emission rate is computed on the basis of the amount of substitute fuel required, assuming that all the sulfur in the fuel becomes SO_2.

(h) The effectiveness of the fuel substitution in reducing sulfur oxide and other pollutant emissions is computed as the change in emissions divided by the old emission rate. Any substitution producing a positive effectiveness at this point is judged acceptable. If no reduction in SO_2 emissions is achieved, the substitution is unacceptable, and another substitute fuel is tested, Step (e).

5.5 MODEL OUTPUTS

As the Control Cost Model serves two basic functions within the Implementation Planning Program, two distinct types of output are generated. Essentially the same data go into making up each of the two output records, but distinctly different formats are used.

5.5.1 Printed Output

The Control Cost Model generates a user-oriented, hard-copy, printed output. This output summarizes the calculations and decision steps described in the preceding sections. The format used presents sufficient detail so that persons familiar with air pollution control technology can evaluate the reasonableness of the results achieved. This review serves two basic purposes:

(a) The assumptions and approximations used in the model can be evaluated on the basis of actual data available in the air quality control region under consideration.

(b) Since estimates generated by the Control Cost Model form a basic input to the Control Strategies Model, any errors or omissions in the Control Cost Model output must be discovered and corrected before meaningful strategy evaluations can be attempted.

Cost and effectiveness estimates for each applicable control device are presented for each point source of pollution identified in the region. The general characteristics of the printed output are described in this section; a detailed description of the output is presented in Chapter 9.

(a) Source Identification. Each source is identified by:

(1) A general industrial and/or process name.

(2) The Standard Industrial Code Classification.

(3) A site code and process number.

These items allow the user to judge the validity of the control device selections made by the Control Cost Model.

(b) Source Description. Certain input data items are included in the output record to aid in the user's evaluation. The number of annual operating hours and the exhaust gas volume are included, since these are important parameters in determining device cost. The type and efficiency of any existing controls are output. Existing emissions are printed to allow comparison with the values estimated after the application of control devices. The source's emissions without existing controls, if any, are also displayed so that the user is made aware of the degree of pollution control already in effect at the source.

(c) Control Device. For each control device judged applicable in the Control Cost Model, the following items are displayed in the printed output:

(1) Device name and code number.

(2) Total annualized cost and its component parts; capital charge and operating and maintenance expense.

(3) Pollutant removal efficiency.

(4) Resulting emissions after device application.

(5) Effectiveness of the control device in terms of dollars per ton of pollutant removed.

5.5.2 Disk File Output.

This Control Cost Model output is an internal transmission of data to the Control Strategies Model. Essentially the same data described in Section 5.5.1 are contained in this output transmission.

The user has the option of changing or correcting any element in this output which he feels to be in error before the operation of the Control Strategies Model. If, after examination of the printed output, the user decides the estimates for any particular source-control device combination should be modified, he may input corrections in punched card form. The detailed procedure and formats to be used in making these changes are described in Chapter 8.

6.0 CONTROL STRATEGIES MODEL

6.1 PURPOSE

The basic function of the Implementation Planning Program is to evaluate the effects of various regional air pollution control alternatives on ambient air quality levels and control costs. This capability is exercised through application of the Control Strategies Model, which brings together the economic and technical estimates generated by the Control Cost Model and the regional dispersion patterns produced by the Atmospheric Diffusion Model.

The Control Strategies Model can be used to simulate the enactment of a variety of emission standards* for suspended particulate matter and sulfur dioxide. The effect of these standards on ambient air quality is projected by the model, together with an estimate of the cost to individual pollutant sources and to the region as a whole. Provision is made for each political jurisdication within the region to select a set of emission standards independently of other jurisdictions, and a realistic simulation of legislatively possible and politically feasible air pollution control efforts can thus be made.

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*An emission standard is a limitation placed on individual sources of a particular pollutant. Generally speaking, different emission standards are applicable to different classes of sources. For example, there are emission standards to control particulate emissions from industrial processes, fuel combustion, and solid waste disposal. Emission standards may be expressed in terms of mass per unit gas volume or mass per unit time. In the latter case, the emission standards usually vary according to the size of the source. An emission control strategy is made up of the emission standards selected for various classes of sources. A control strategy for particulate matter would include emission standards for combustion sources, industrial process sources, and solid waste disposal sources. Each political jurisdiction within a region may have a different strategy, provided all strategies are compatible. When an emission control strategy is developed into a legally enforceable requirement, it is then called an emission control regulation. A point source of emissions is defined as any individual source for which specific information is input into the program (usually specified on a single stack basis). An area source includes the total emissions from all sources in a grid square which are too numerous to specify on an individual basis, (e.g., residential fuel combustion, automobiles, backyard incineration, etc.).

6.2 INPUT INFORMATION

The Control Strategies Model is designed to be run in conjunction with the Control Cost and Atmospheric Diffusion models, which generate the basic data inputs to the Control Strategies Model (see Chapters 4.0 and 5.0). The Control Strategies Model also makes use of information on pollution sources, control devices, meteorology, etc., which is input by the user and stored on accessible disk storage files (see Chapters 7.0 and 8.0).

The following subsections describe the data supplied to the Control Strategies Model by the two other Implementation Planning Program models, as well as the inputs which must be supplied by the user.

6.2.1 Inputs from the Control Cost Model

The basic calculations of the relative costs and efficiencies of control devices are made within the Control Cost Model. These calculations are carried out for each pollution source identified in the regional emission inventory. The exact items calculated are described in more detail in Chapter 5.0. In general, the information transmitted from the Control Cost Model to the Control Strategies Model is as follows:

(a) Control Device Assignment. A list of applicable control devices and measures is supplied to the Control Strategies Model for each point source identified in the region (computations and criteria used in assigning device applicability are discussed in detail in Chapter 5.0). For each source, the list includes all available control alternatives which can be used in attempting to meet the various emission standards.

(b) Control Efficiency. The efficiency of each control device or measure is supplied to the Control Strategies Model. These efficiencies represent the degree of pollutant removal expected as a result of applying a control device to a particular source. The removal efficiency, expressed as a percentage, is given for particulates and sulfur dioxide.

(c) Device Costs. The total annualized cost is given for each source-device combination generated by the Control Cost Model. The figure includes both an annual capital charge (based on the purchase and installation costs) and yearly operation and maintenance expenses. On the basis of this data, the model selects for each source the least costly method whereby the various emission standards may be met.

(d) Emission Characteristics. In addition to reducing the quantity of pollutants emitted, many control devices also alter the characteristics of the effluent gas stream. Changes in the exhaust gas volume, temperature, or exit velocity all affect the atmospheric dispersion of pollutants from a source. Such gas-stream modifications are calculated in the Control Cost Model and utilized in the subsequent evaluation of control strategies.

6.2.2 Inputs from the Atmospheric Diffusion Model

The contribution of every pollution source to the ground-level pollutant concentration at each receptor location is available from the Atmospheric Diffusion Model. In evaluating the impact of various control strategies on regional air quality, these contributions are scaled according to the degree of pollution reduction required. Point sources are scaled on the basis of selected control device efficiencies. For area sources, no specific control devices are selected. However, a single, region-wide area source scale factor may be input to simulate improved control of automobile exhaust, open burning restrictions, etc. The feasibility of using a particular set of emission standards (i.e., a control strategy) to achieve the desired air quality level can thus be estimated.

Certain control devices (notably liquid scrubbers and afterburners) produce significant changes in the exhaust gas characteristics. When these emission controls are applied, the scaling procedure described above will not lead to meaningful ground-level concentration estimates. One of the subroutines used in the Atmospheric Diffusion Model is available within the Control Strategies Model to recompute the expected ground-level concentrations on the basis of the new effluent gas stream characteristics.

6.2.3 Control Information

The user has a number of options in applying the Control Strategies Model. These must be specified prior to program execution. The input information required in selecting the various program options is discussed in Chapter 8.0.

6.2.4 Emission Standard Data

The Control Strategies Model is structured to calculate allowable emission rates for each point source under a selected set of emission standards. The program then applies to the source a control measure from the list generated by the Control Cost Model and selects the least-cost measure which reduces emissions to the allowable level. Two conditions may occur which require the user to manually input data* in the course of these procedures:

(a) In any given air quality region, certain emission standards not available in the program may be of particular interest. These standards might require information not in the program (e.g., distance from the point of emission to the nearest property line). Such manually-input standards can be evaluated if the user is able to supply, in punched card format (See Chapter 8.0), the following data for each source to which the standard applies:

- Allowable emission rate
- Type of control device which meets the standard
- Required control efficiency
- Annualized cost of the control measure
- Any changes in exhaust gas characteristics (i.e., temperature, velocity, volume, etc.)

The user thus has the capability of evaluating any emission control strategy which may be of particular interest to a region but which has not been pre-programmed into the model.

(b) Manually-input data may also be required in the selection of appropriate control devices to meet each emission standard. For any source, the Control Strategies Model can only consider those control devices selected by the Control Cost Model. If none of the control devices meets an emission standard, then the Strategies Model is unable to completely evaluate the effect of implementing this standard. In such a case, it would be desirable for the user to supplement the internal analytic capabilities of the model. On the basis of experience in air pollution control technology, it will usually be possible to specify a device which will produce the necessary emission reduction, as well as an estimate of cost for applying this device to the particular source. Addition of this information will increase the accuracy of the strategy evaluation procedure.

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*To assist the user in preparing manual input data, two unformatted computer lists are provided as shown in the end of this chapter (Figures 6-9, 10).

6.3 MODEL OPERATIONS

The Control Strategies Model is broken down into two major segments, in order to reduce execution time when evaluating a large number of strategies for a given region. These segments can be run independently, i.e., as separate job steps. By applying all candidate emission standards within one category to all sources in that category, (e.g., particulate emissions from fuel combustion), a file is created (job step 1) which can be used repeatedly as the standards are assembled (job step 2) in various ways. The file can be changed manually as required, or the first job step can be rerun as often as desired with, say, the emission standard levels adjusted.

6.3.1 Emission Standard Module

The Control Strategies Model applies each applicable emission standard to every point source in the region. The allowable emissions are calculated and, based on the control device information generated by the Control Cost Model, an appropriate device is selected for each source-standard combination. Control devices are selected on the following basis:

(1) The controlled emission after application of the device must be less than the allowable emissions defined by the standard.

(2) If more than one device produces sufficiently low emissions, the device having the lowest annualized cost is selected.

When none of the available devices allows the source to meet a particular emission standard, the most efficient* device is selected, and a flag is placed on the output record to indicate that the user should determine the availability of a suitable but more effective control device.

At the present time, the Control Strategy Model already has a number of emission standards built into it. (Table 6-1 and Figures 6-1 through 6-8). While these emission standards are already pre-programmed into the system, other standards can be considered and evaluated. The "type" column listed in the attached tables indicates the basic format for each

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*This quantity is on an equipment design basis; the actual emissions are adjusted to reflect design operating conditions in the determination of the control required.

emission standard. For instance, "heat input" indicates that the amount of pollutant a source may release is based on the quantity of heat energy input into the combustion source The variable terms shown for each standard are those which the user may adjust to suit the specific conditions and requirements of a control region. The present values of these variables are presented under the "Standard Statement" or are shown in the attached Figures. These values are used by the program unless the user specifies otherwise (details on format and input procedure are given in Chapter 8.0). The "curve coordinates" notation in the Input Variables column of the attached tables indicates that the curve may be moved in any manner the user desires as long as it remains a series of connected straight-line segments on log-log paper. For example, any emission standards based on heat input, process weight, or potential emission may be evaluated by the program.

For the sulfur oxide emission standards, fuel substitution may be evaluated provided the sulfur limit is defined for all fuels as a whole. The program cannot distinguish the difference between a source using coal and one using residual oil. Therefore, sulfur limitations must cover all fuels rather than each individual type of fuel (coal, oil, and gas).

In summary, the emission standards that can be evaluated with the Implementation Planning Program as it presently exists are as follows:

Suspended Particulate Matter

  Fuel Combustion Sources

    (a) Heat Input
    (b) Potential Emissions
    (c) Maximum Control Technology

  Industrial Process Sources

    (a) Process Weight
    (b) Potential Emissions
    (c) Maximum Control Technology

Solid Waste Disposal Sources

- (a) Grain loading (Incinerators)
- (b) Potential Emissions (Incinerators)
- (c) No open burning

Sulfur Dioxide

Fuel Combustion Sources

- (a) Pounds of sulfur per million BTU input (for all fuels)
- (b) Percent sulfur limit for all fuel

Industrial Process Sources

- (a) PPM basis

The emission standards described above are applicable only to stationary point sources. The effect of controlling area sources (a category which includes mobile sources, residential fuel combustion, residential solid waste disposal, etc.) can also be determined with the program. For instance, if open burning were prohibited or construction and demolition activities reduced, the effects may be evaluated provided the user knows the percent of total area emissions contributed by the given category. For example, if particulate emissions from backyard open burning account for 10% of the total area emissions, the program will reduce all area sources by a uniform 10%. This reduction will then be reflected in the air quality predicted by the program.

Alter calculation of permissible emissions for each source and applicable emission standard, the computer program selects the best available control device. A file of the data thus compiled is created and can be reviewed by the user to determine whether any additions or corrections are required before continuing with the next job step. When a complete, corrected file of the various alternative emission control standards has been compiled, the task of strategy simulation and evaluation is begun.

6.3.2 Strategy Selection Module

In defining the control strategy for a particular region, the user specifies, for each of the political jurisdictions which make up the region, the number of the emission standard to be applied to sources in each of the fuel-combustion, industrial-process, and solid-waste categories.

In addition to the input matrix of emission standard numbers, Job Step 2 requires the control regulation file generated by Job Step 1 as well as the source contribution file from the Atmospheric Diffusion Model. All emission standards in a given category will have been applied to all sources in that category, and the resulting allowable emissions, controlled emissions, device selected, and cost data stored on the disk.

The user must input a punched card specifying the emission standard for every source category in each political jurisdiction. The summation of the areas making up the political jurisdictions is sufficient to just cover the entire region, with no gaps and no overlap.

The Control Strategies Model reads the first of these cards, determines the political jurisdiction and standard number for the first source category (fuel combustion), and searches the emission standard file, picking up the records for all sources in this jurisdiction and controlled under this standard number. Upon completion of two additional searches through the file for industrial process and solid waste disposal records, the model reads the next input card, defining the regulation structure for the next political jurisdiction. When all input cards have been read, every source in the region will have been considered.

The source records are read from the disk one at a time, moved into an area in the core for inclusion in output tables, and used to create a new file on the disk. This file is used in scaling the estimated ground-level concentrations to reflect the addition of the control devices required by the control strategy under evaluation.

6.3.3 Control Strategies Model Output

The output from the Control Strategies Model is designed to give a comprehensive picture of the impact of the strategy on the political jurisdictions which make up the region, as well as on individual sources and the region as a whole. Each run of the model provides a strategy evaluation for a single pollutant and requires analysis of emissions of that pollutant from every source in the region. Since each control authority is primarily concerned with sources within its own area, the effects of a strategy on individual sources are described separately for each jurisdiction. In the presentation of estimated air quality after application of the strategy, the distinction between political jurisdictions is dropped.

The computer outputs illustrate emission standards as though they were incorporated into enforceable emission regulations. The Regulation Effects on Source Emission tables (see Chapter 9.0) are presented, one political jurisdiction at a time, in the order in which the user has numbered the jurisdictions. Within a particular jurisdiction, the sources are grouped into fuel combustion, industrial process, and solid waste disposal categories. For every source, the SIC code and site number are shown (see Section 8.1.1, item A). The identification numbers, cost, and efficiency of the control device selected to bring the source into compliance with the control regulation, as well as the existing, allowable, and controlled emission, are also presented. If no device is required, i.e., if the existing emissions are already less than those allowable under the regulation, this fact is indicated. Conversely, if there is no control device which can achieve the allowable emission, the model so indicates and selects the best available device. After all three source categories have been covered, a one-page summary table is output, including the following quantities:

Total Applicable Point Sources for each source category.

Total Controlled Point Sources, showing the fraction of applicable point sources which require additional control under each category.

Existing Emissions for Point Sources, a summation of all emissions for sources within each category.

Emission Reduction, showing the reduction resulting from control of sources in each category.

Annual Control Cost for the devices applied in each category.

Control Cost per Ton Removed, giving the relative costs of the emission reduction achieved in each category.

Several figures of merit are included to show the effects of the strategy throughout the jurisdiction. For both existing and controlled emissions, the total emission and point and area source contributions are given. The relative importance of area sources may thus be evaluated as the point source contributions are controlled. The total reduction of point source contributions is also presented in terms of absolute and percentage reduction, and as a cost-effectiveness figure (dollars per unit reduction).

This output is repeated for every jurisdiction.

A final regionwide summary allows study of the relative contributions of each of the jurisdictions, as well as determination of the cost each must bear under the proposed strategy. The data presented are the same as for the individual jurisdications, except that each line in the table consists of totals for all jurisdictions. For this overall summary, the distinction between source categories is dropped. The air quality levels after control are provided on punched cards which can be used to produce a regionwide picture of air quality levels in the form of isopleths of pollutant concentrations at ground level.

TABLE 6-1 EMISSION STANDARDS

a. PARTICULATES -- Fuel Combustion Emission Standards

Standard Number	Type	Statement of Emission Standard	Input Variables
1	Heat Input	Use Missouri curve (Figure 6-1) of heat input vs. allowable emission; maximum allowable, 0.6 lbs./10^6 BTU input.	Curve coordinates
2	Heat Input	Use Illinois curve (Figure 6-2, Modified ASME Curve) of heat input vs. allowable emission.	Curve coordinates
3	Heat Input	Use the modified ASME curve (Figure 6-3) of heat input vs. allowable emission; 85% minimum control on all units with heat input of 5×10^6 BTU or more.	Curve coordinates; minimum control level
4	Heat input	Use Ironton-Ashland-Huntington curve (Figure 6-4) of heat input vs. allowable emission.	Curve coordinates
5	Potential Emission	Use Pennsylvania Potential Emissions Curve (Figure 6-5) giving potential emission rate vs. allowable emission rate.	Curve coordinates
6	Maximum Technology	Use the most efficient device for each source, as determined by the Control Cost Model.	None
b. PARTICULATES -- Industrial Process Emission Regulation			
1	Process Weight/ Exceptions	Use San Francisco curve (Figure 6-6) of process weight rate vs. allowable emission rate; maximum of 0.3 g/scf. EXCEPTION: Gray Iron foundries which must have 85% control or 0.4 g/scf, whichever is more stringent.	Maximum emission; maximum emission for foundries; control percentage for foundries S.F. curve coordinates.

TABLE 6-1

b. PARTICULATES -- Industrial Process Emission Regulation (Continued)

Standard Number	Type	Statement of Emission Standard	Input Variables
2	Process Weight/ Exceptions	Use San Francisco curve (Figure 6-6) of process weight rate vs. allowable emission rate. EXCEPTIONS: (i) Catalytic crackers, 99.7%; (ii) blast furnaces, sintering plants, open hearth furnaces, electric furnaces, basic oxygen furnaces. 0.1 g/scf; (iii) foundries < 20,000 lbs/hr, use process weight curve, in Figure 6-7 (over 20,000 lbs/hr use S.F. curve); (iv) cement mfg, 99.7% control, not to exceed 0.1 g/scf.	Refinery percentage efficiency furnace grain loading; foundry break point; foundry curve, cement efficiency and max emission; S.F. curve coordinates.
3	Process Weight	Use San Francisco curve (Figure 6-6) of process weight rate vs. allowable emission rate.	S.F. curve coordinates
4	Potential Emission	Use Pennsylvania Potential Emission Curve (Figure 6-5) of potential emission vs. allowable emission rate.	Curve coordinates
5	Max Technology	Use the most efficient device for each source, as determined by the control cost model.	None
6	Process Weight	Use L.A. Curve (Figure 6-8) of process weight rate vs. allowable emission rate.	Curve coordinates

c. PARTICULATES -- Solid Waste Disposal Emission Standards

1	Exhaust Concentration	Incinerators $\leq$ 200 lbs/hr, 0.2 g/scf corrected to 12% CO_2; incinerators > 200 lbs/hr, 0.3 g/scf corrected to 12% CO_2; no open burning.	Incinerator capacity break point; grain; loading above and below break point.

TABLE 6-1

c. PARTICULATES -- Solid Waste Disposal Emission Standards (Continued)

Standard Number	Type	Statement of Emission Standard	Input Variables
2	Exhaust Concentration	Incinerators > 1000 lbs/hr, 0.2 g/scf adjusted to 50% excess air: < 1000 lbs/hr, .35 g/scf adjusted to 50% excess air; no open burning.	Incinerator capacity break point; grain loading above and below break point.
3	Potential Emission	For incinerators use Pennsylvania Potential Emissions curve (Figure 6-5) giving potential emission rate vs. allowable emission rate; no open burning.	Curve coordinates.
d. SOX -- Fuel Combustion Emission Standards			
1	Heat Capacity	Units > 2000 x 10^6 BTU/hr, maximum emission of 2.3 lbs/10^6 BTU input; units less than 2000 x 10^6 BTU/hr, limited to 2% sulfur fuel.	Unit heat capacity breakpoint level of max emission; fuel sulfur limitation.
2	Straight Reduction/ Fuel Restriction	85% reduction on power plants and 2% sulfur fuel on all other sources.	Percentage reduction on power plants; fuel sulfur limitation.
3	Fuel Restriction	All sources use maximum 1% sulfur fuel.	Fuel sulfur limitation.

TABLE 6-1

e. SOX -- Industrial Process Emission Standards

Standard Number	Type	Statement of Emission Standard	Input Variables
1	Exhaust concentration	All existing units 2000 ppm	Max concentration
2	Exhaust concentration	All existing units 500 ppm	Max concentration

f. SOX -- Solid Waste Disposal Regulations

None

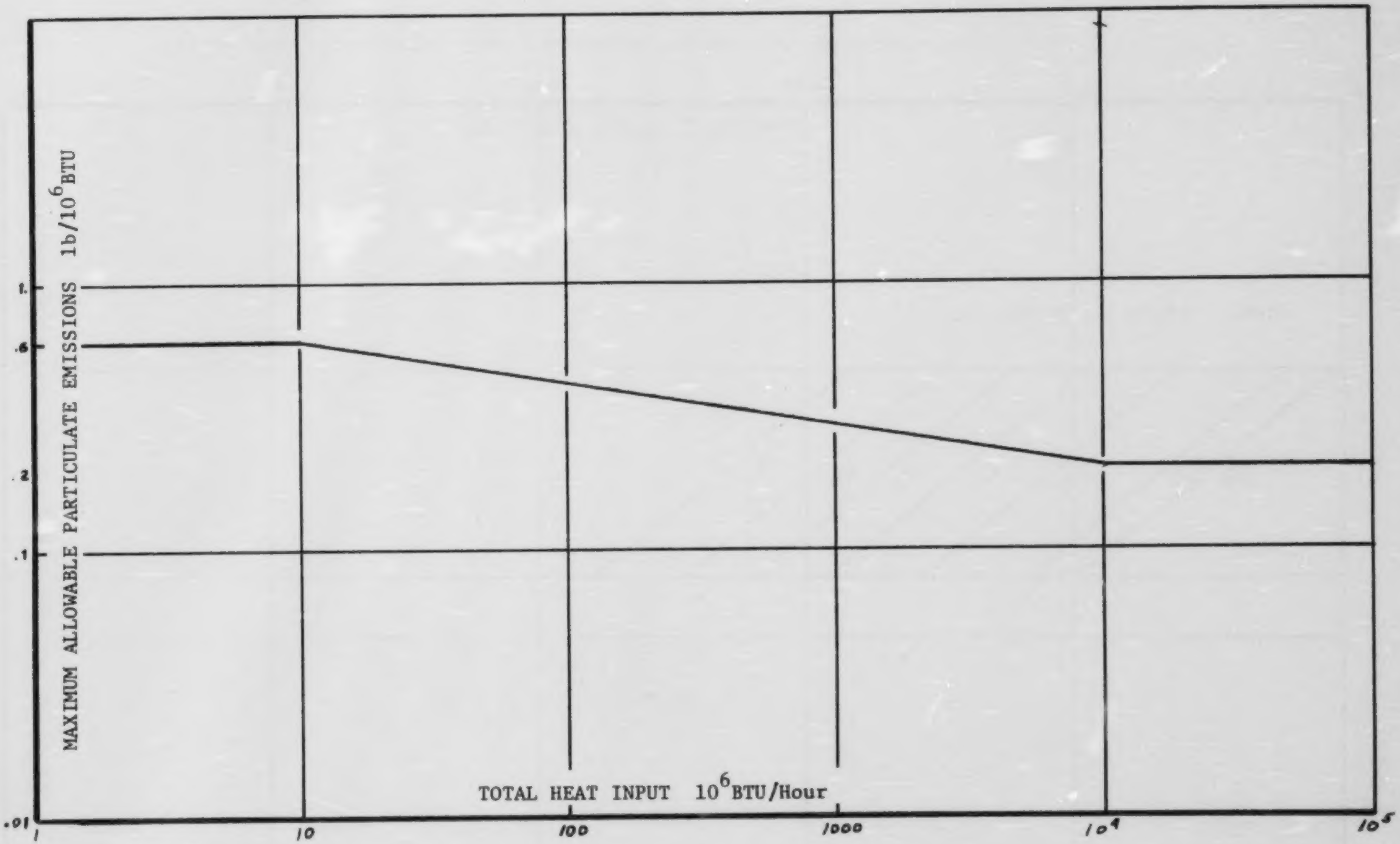


Figure 6-1. Particulate Fuel Combustion Standard #1 (Missouri)

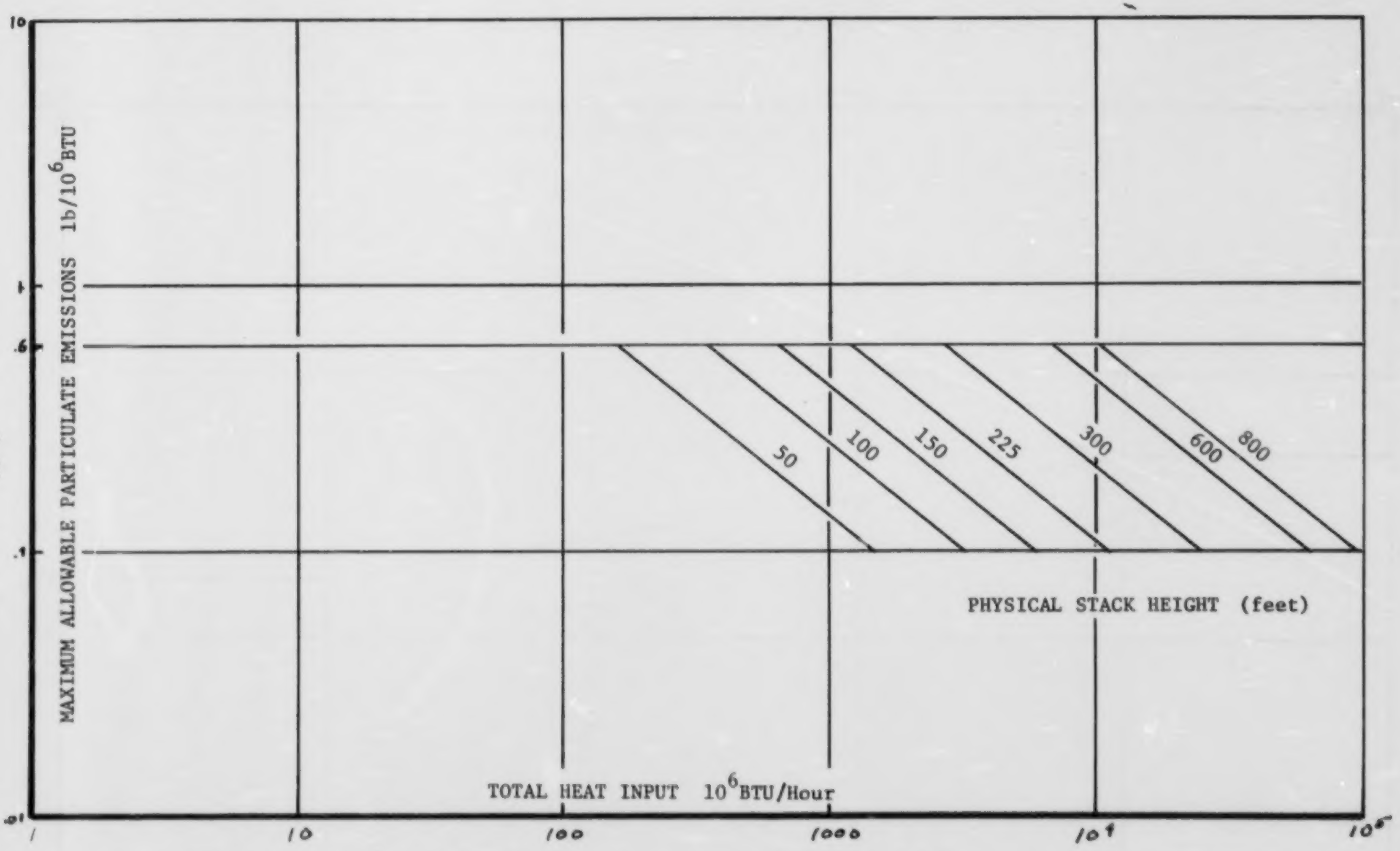


Figure 6-2. Particulate Fuel Combustion Standard #2 (Modified ASME, Illinois)

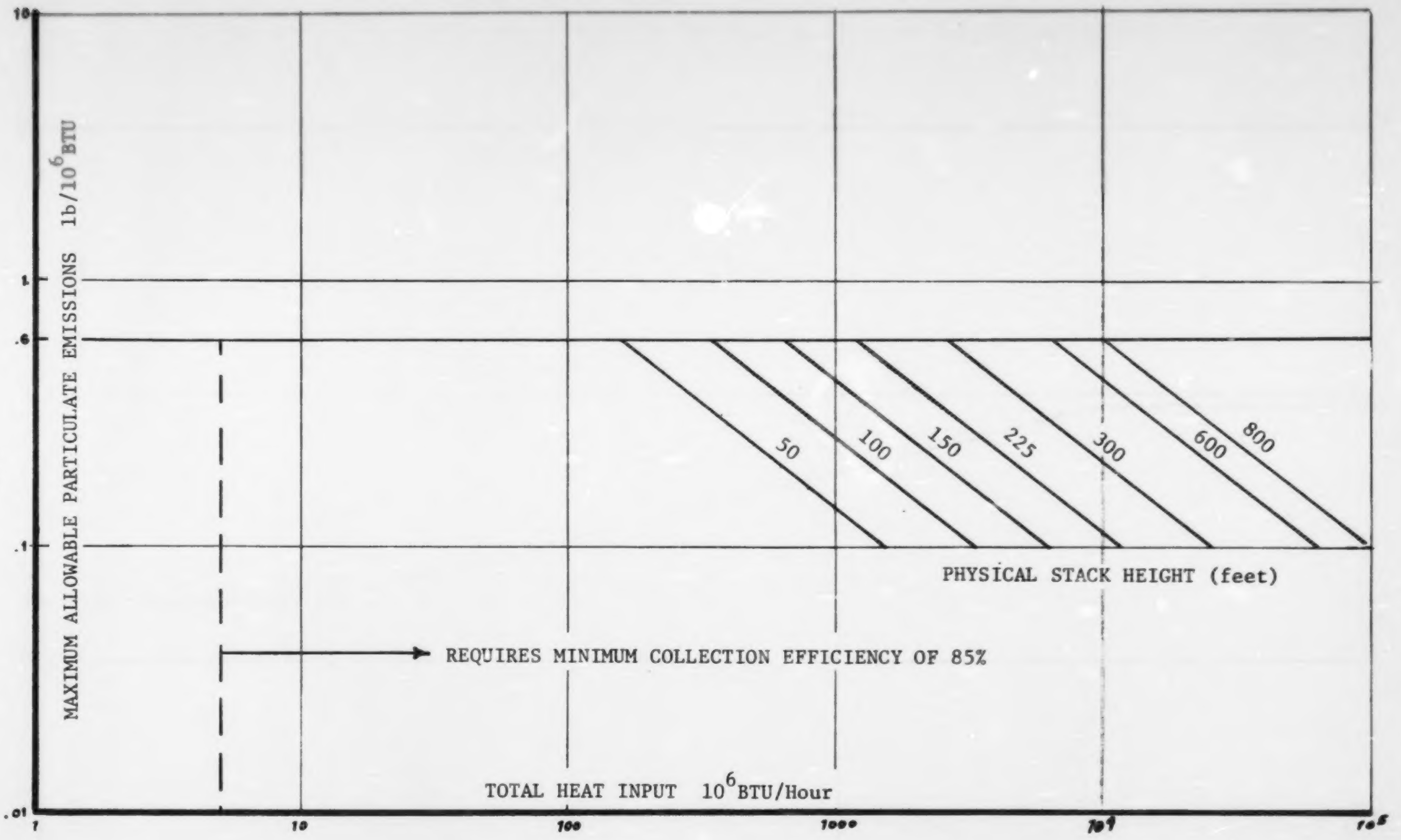


Figure 6-3. Particulate Fuel Combustion Standard #3 (Modified ASME with Min. Control, Missouri)

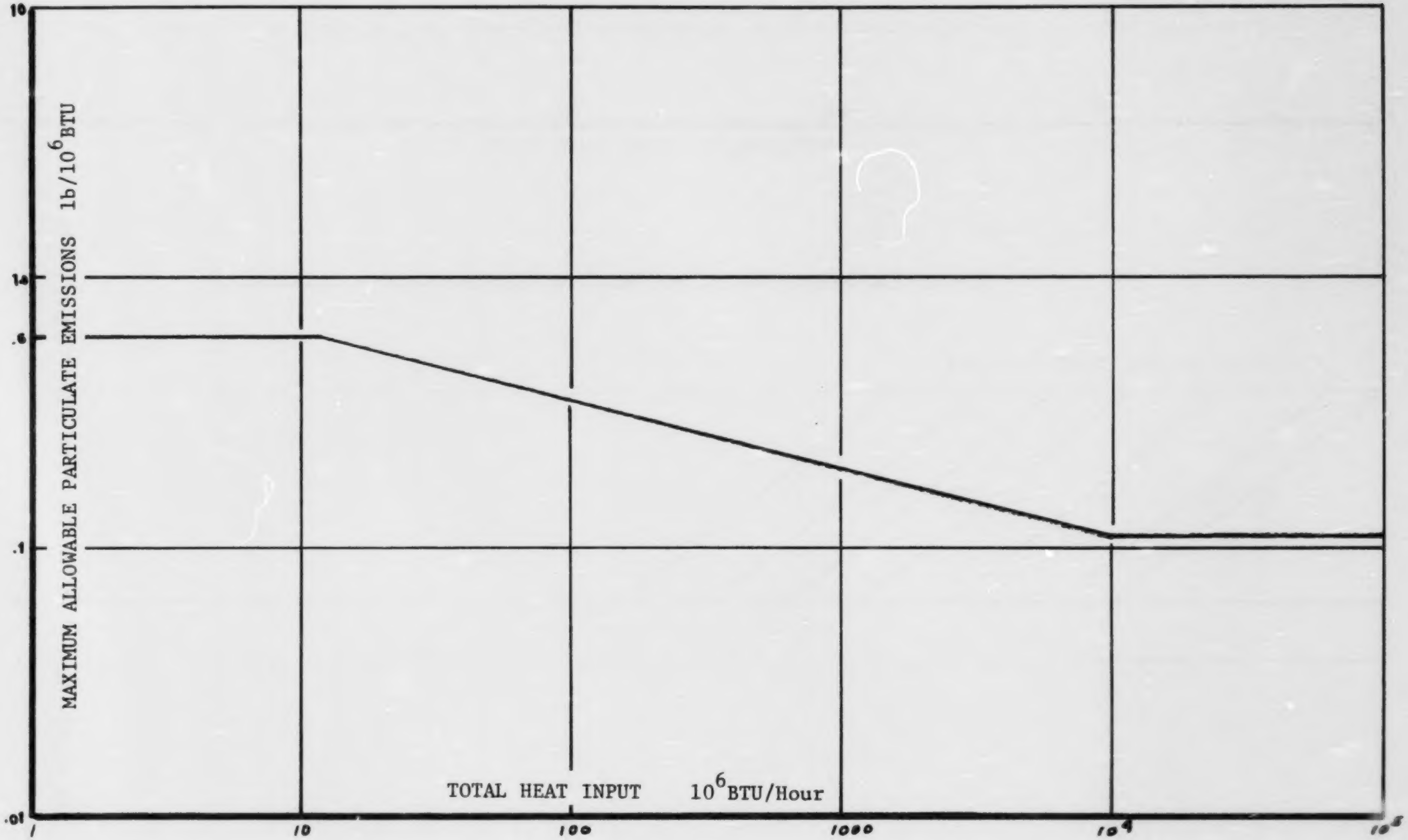
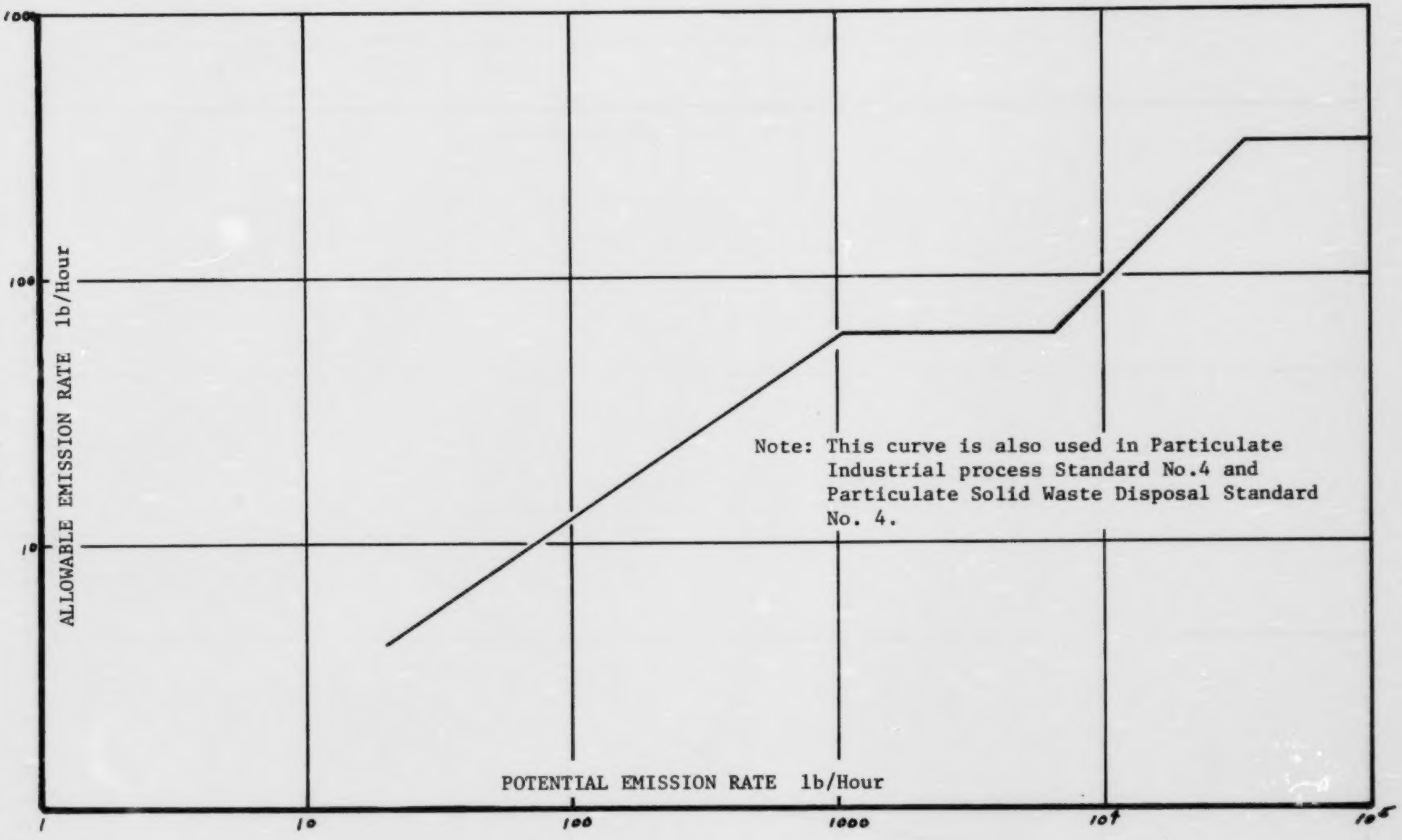
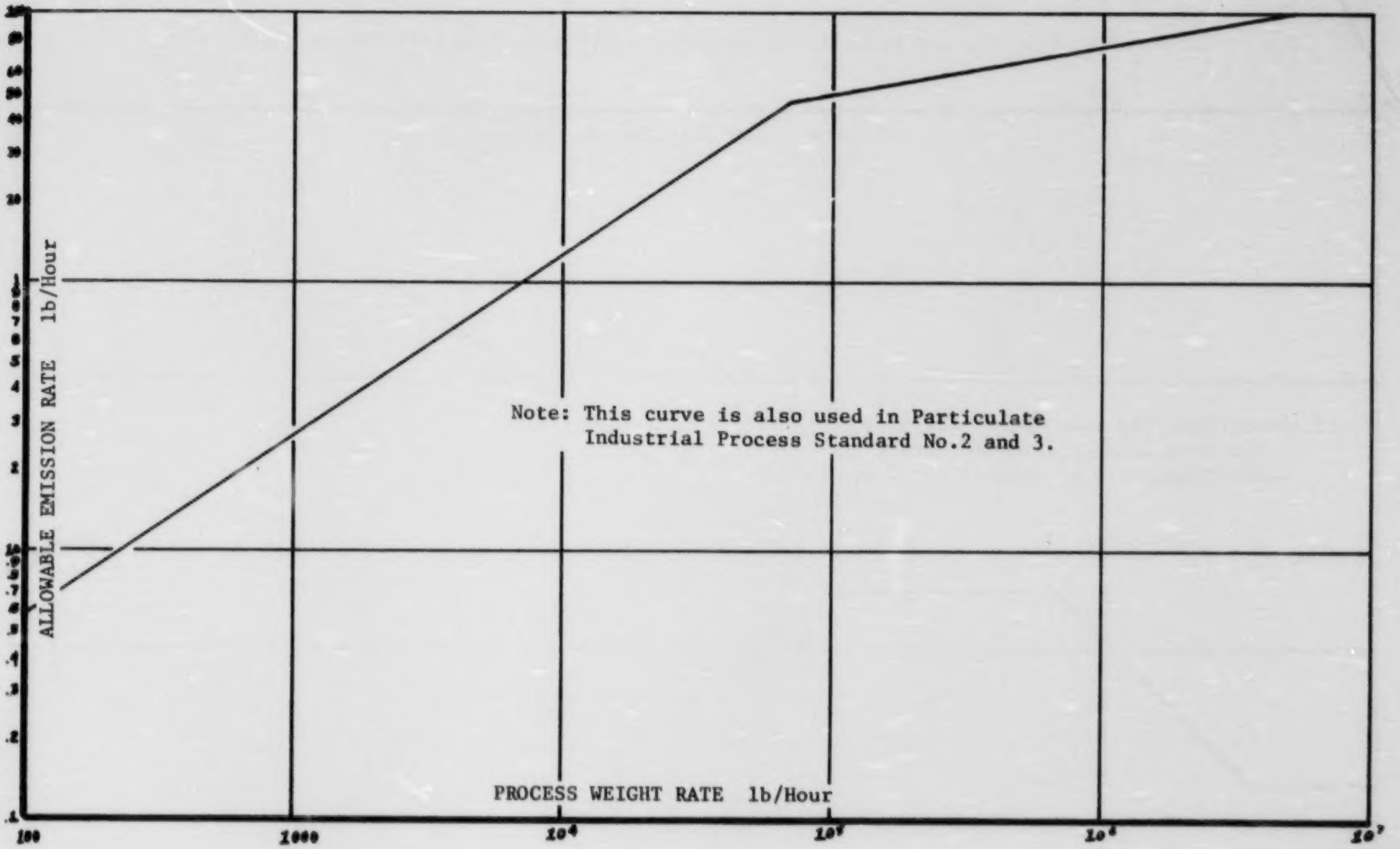


Figure 6-4. Particulate Fuel Combustion Standard #4 (Ironton-Ashland-Huntington)



Note: This curve is also used in Particulate Industrial process Standard No.4 and Particulate Solid Waste Disposal Standard No. 4.

Figure 6-5. Particulate Fuel Combustion Standard #5 (Pennsylvania Potential Emissions)



Note: This curve is also used in Particulate Industrial Process Standard No.2 and 3.

Figure 6-6. Particulate Industrial Process Standard #1 (San Francisco Process Weight)

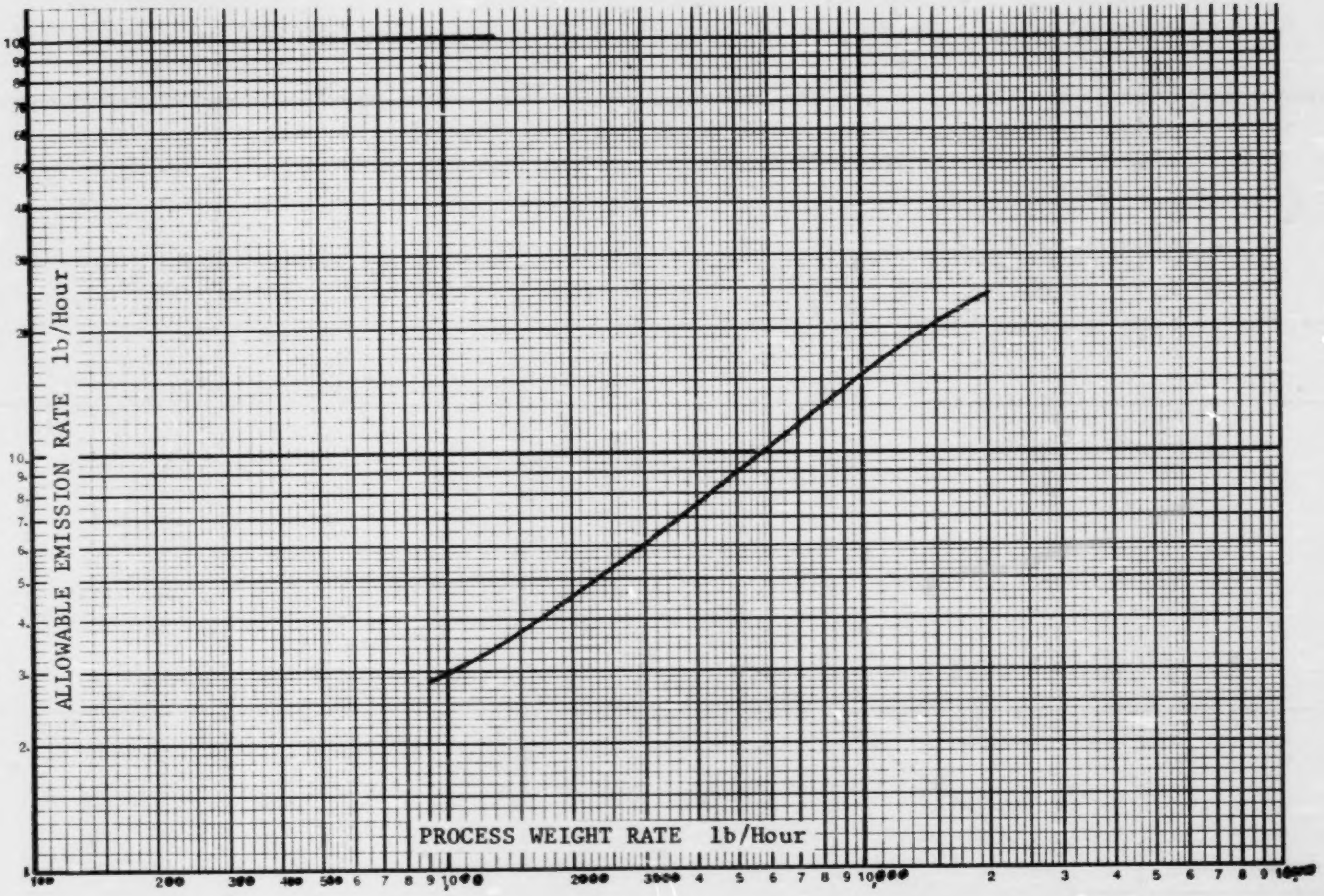


Figure 6-7. Particulate Industrial Process Standard #2 (Same as 6-6 with Foundry Exceptions)

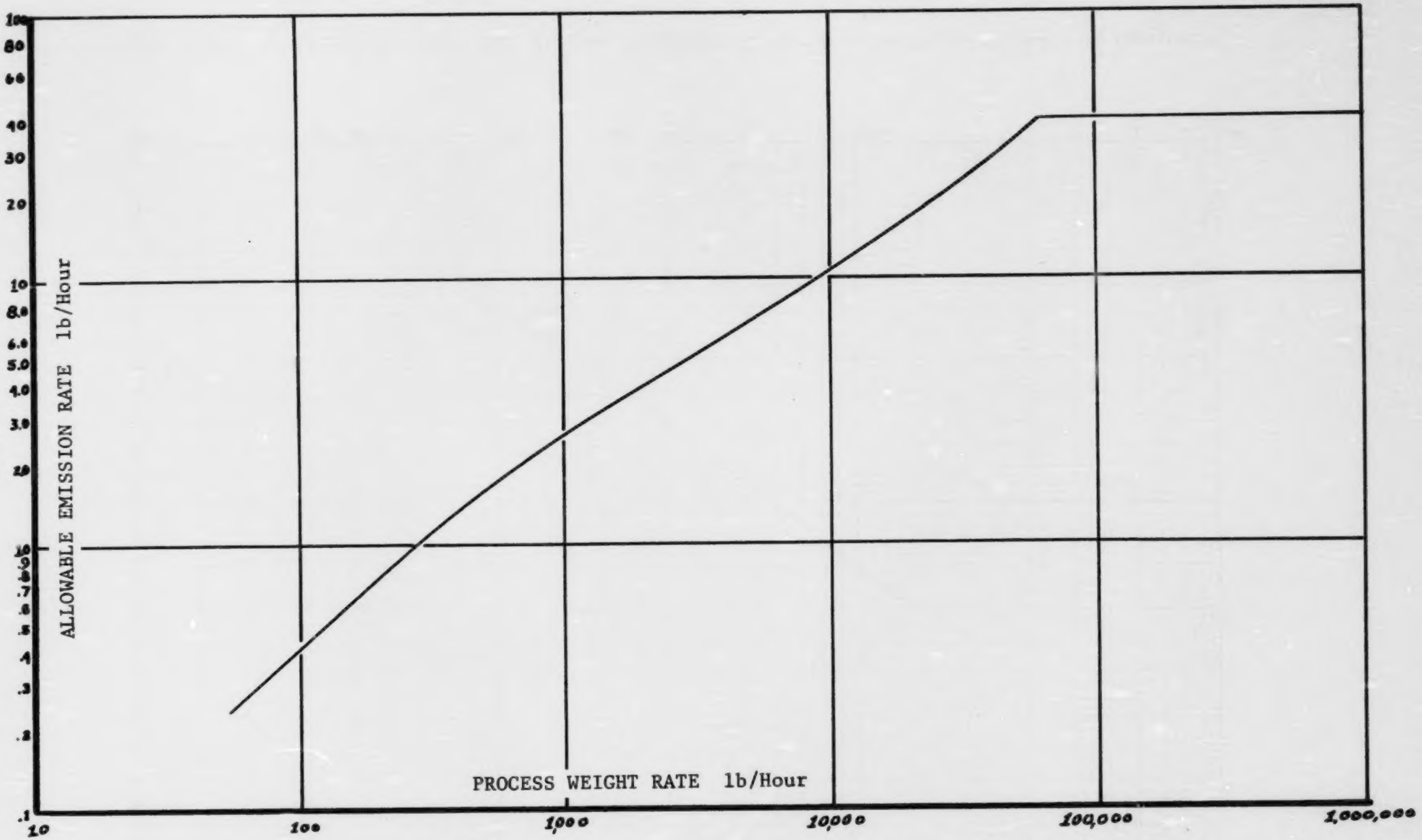


Figure 6-8. Particulate Industrial Process Standard #6 (Los Angeles Process Weight)

```
&STRATM
IREGR=          907,LSOR=    28190331,IDDEV=          14,PRTYI
 0.0             ,DEVEFC= 0.0                ,DEVEFP= 0.98999965
PRCRTM=  1100.0000      ,SHIFTS=  3.0000000      ,STKHTN=  30
  362.00000      ,RATCAP= 0.0                ,OFSCO= 0.0
  82145.250      ,DESER= 0.0                ,DESPER= 0.0
&END
&STRATM
IREGR=          907,LSOR=    28190331,IDDEV=          15,P
 0.0             ,DEVEFC= 0.0                ,DEVEFP= 0.8499
PRCRTM=  1100.0000      ,SHIFTS=  3.0000000      ,STKHTN
  362.00000      ,RATCAP= 0.0                ,OFSCO= 0.0
  54533.438      ,DESER= 0.0                ,DESPER= 0.0
&END
&STRATM
IREGR=          907,LSOR=    28190340,IDDEV=
 0.0             ,DEVEFC= 0.0                ,DEVEFP= 0.5
PRCRTM= 0.0              ,SHIFTS=  3.0000000      ,STKHT
  500.00000      ,RATCAP= 0.35840000E 09,OFSCO= 0.289
  27710.566      ,DESER=  3.9642687      ,DESPER=  21.19
&END
&STRATM
IREGR=          907,LSOR=    28190340,IDDEV=          10,PR
 0.0             ,DEVEFC= 0.0                ,DEVEFP= 0.98399955
PRCRTM= 0.0              ,SHIFTS=  3.0000000      ,STKHTN=  24.
  500.00000      ,RATCAP= 0.35840000E 09,OFSCO= 0.28999988E-0
  70041.500      ,DESER=  3.9642687      ,DESPER=  21.199249
&END
```

NOTE: This portion of a computer output list illustrates the information passed internally from the Control Cost Model and Source File to the Control Standards Segment ((ØNREG) of the Control Strategies Model. Each record in this list, starting with the namelist variable &STRTM and ending with &END, represents one source-device combination. Any field in this list identified by a namelist variable can be changed in accordance with Section 8.5.

Figure 6-9. Strategy Input File Update

```
REGION 907 SOURCE 2800 410 DEVICE  27 COST     184388. EFF SO2
HS  24.00 TEMP 483.00 DIA   2.56 VEL  17.80 STACK   0 COST
P-PJ-CL-REG-FL 1 21 10

REGION 907 SOURCE 2800 410 DEVICE  27 COST     184388. EFF SO
HS  24.00 TEMP 483.00 DIA   2.56 VEL  17.80 STACK   0 COST
P-PJ-CL-REG-FL 1 21 20

REGION 907 SOURCE 2800 410 DEVICE  28 COST     330275. EFF
HS  24.00 TEMP 483.00 DIA   2.56 VEL  17.80 STACK   0 CO
P-PJ-CL-REG-FL 1 21 30

REGION 907 SOURCE 2800 410 DEVICE  33 COST    1164314.
HS  24.00 TEMP 483.00 DIA   2.56 VEL  17.80 STACK   0
P-PJ-CL-REG-FL 1 21 40

REGION 907 SOURCE 2800 410 DEVICE  12 COST      67966.
HS  24.00 TEMP 483.00 DIA   2.56 VEL  17.80 STACK   0 C
P-PJ-CL-REG-FL 2 21 10

REGION 907 SOURCE 2800 410 DEVICE  12 COST      67966. EF
HS  24.00 TEMP 483.00 DIA   2.56 VEL  17.80 STACK   0 CO
P-PJ-CL-REG-FL 2 21 20

REGION 907 SOURCE 2800 410 DEVICE  12 COST      67966. EFF
HS  24.00 TEMP 483.00 DIA   2.56 VEL  17.80 STACK   0 COST
P-PJ-CL-REG-FL 2 21 30

REGION 907 SOURCE 2800 410 DEVICE  12 COST      67966. EFF S
HS  24.00 TEMP 483.00 DIA   2.56 VEL  17.80 STACK   0 COST
P-PJ-CL-REG-FL 2 21 40
```

NOTE: This portion of a computer output list illustrates the information passed internally from the Control Standards (CØNREG) to the Strategy Output (CSTAB) segments of the Control Strategies Model. Each record in this list, identified by the Region and Source numbers, represents the source response to a specified emission standard. Each field in this list can be updated in accordance with the inputs specified in Section 8.6.

Figure 6-10. Control Strategies Model Update

7.0 INFORMATION SYSTEM

7.1 INTRODUCTION

The purpose of an information system is to make available, at the proper time and place and in the appropriate form, information necessary to the formulation of accurate decisions. The use of computers in this area has become widespread, and an information system is now defined specifically as a computer program package performing three functions:

(a) Data Storage

(b) Data Input

(c) Data Output.

These functions can take many forms, depending on the particular application of the information system. The storage function generally specifies a way of organizing the required data for retention. The data is stored in fields; several fields represent a record; and several records constitute a file. A file designates the general nature of the data to be stored (e.g., a control device file or an emission inventory file). Records are the next logical level in cataloging the contents of a file. For a control device file, for example, a logical record breakdown would be by device types (filters, precipitators, mechanical separators, etc.). For an emission inventory file, such a breakdown might be in the form of a list of pollution sources identified by industrial category. The final level in this system is the field, a unique piece of data associated with the record. The manufacturer's list price of a specific control device, for example, would be contained in a field within a control device record within the control device file. The exit velocity for a given stack would be contained in a field within a source record within the emission inventory file. Figure 7-1 illustrates the organization of the storage function within an information system.

A second major function of an information system is data input. This function is employed either in the initial creation of a file or in updating the file by adding, changing, or deleting records. Input is carried out in three stages:

(a) an editing or clerical operation which checks the input data for errors;

(b) a value edit which checks the new data for compatibility with existing data; and

(c) the actual manipulation of records to accomplish the data input.

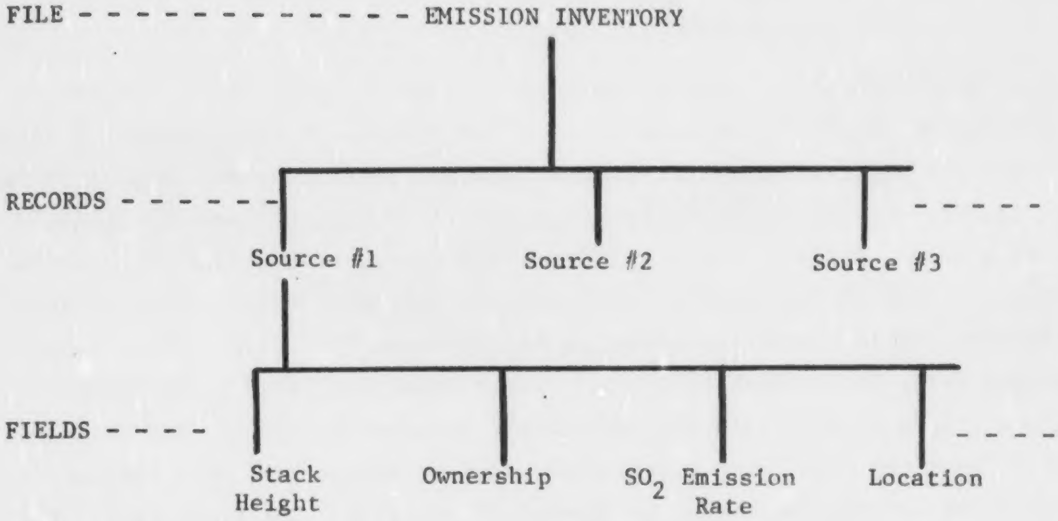

FILE
EMISSION INVENTORY
RECORDS
Source #1
Source #2
Source #3
FIELDS
Stack Height
Ownership
SO_2 Emission Rate
Location

Figure 7-1. Data Storage Organization

The third function of an information system is data output. The output function differs from one system to the next, depending on the requirements of the user. There are, however, three classes of outputs: a bulk report format, specific responses to queries, and computer language outputs intended for related computer programs.

7.2 GENERAL DESCRIPTION

The main features of the Implementation Planning Program information system are:

Data Storage -- Fixed number of fields per record. Unlimited number of records per file. Sequential storage of records.

Data Input -- Editing of input data via pre-programmed dictionaries performing clerical and value checks on input data.

Data Output -- Pre-programmed report formats using logical selection criteria for output data. Computer language outputs for computational interfaces with other models.

7.2.1 Data Storage

The relevant air pollution data and air pollution control information on which the Implementation Planning Program operates constitute the information system data base. This data base has been obtained primarily from National Air Pollution Control Administration documentation. As required, assumptions have been made on the basis of engineering judgment to obtain a more complete or up-to-date set of data.

The data in the files have been organized to facilitate their use by the computational models. The Control Cost Model, the Control Strategies Model and the Atmospheric Diffusion Model all have direct access to the data files.

The files have been structured so that only those fields and records related to a particular task reside within one file. A computational model using input data from several files will receive only the data required by the particular computation.

The files are generated and maintained by a generalized file maintenance routine and are stored on a disk memory device. The disk memory allows for optimum access time in relation to its storage capacity, in supporting both file maintenance and data output.

7.2.2 Data Input

A pre-edit routine and a generalized file maintenance routine are used in processing input data (Figure 7-2).

The pre-edit routine accepts new data inputs and converts them to a form that permits efficient updating in the generalized file maintenance routine. In making this conversion, the routine compares input data to a pre-stored dictionary which identifies the specific fields contained in each record and includes either a format or value limit for each input parameter. On the basis of this comparison, the routine can reject the input data, accept the input data with a caution to the user, or accept the data unquestioningly. In making the conversion and dictionary comparison, the pre-edit routine produces a list of detected errors in input data and an extensive file-edit listing. The file-edit listing serves as a reference document on the history of file update procedures. The final function of the pre-edit routine is the sorting of acceptable input data according to the file sequence. This sorted input data list becomes the input to the generalized file maintenance routine.

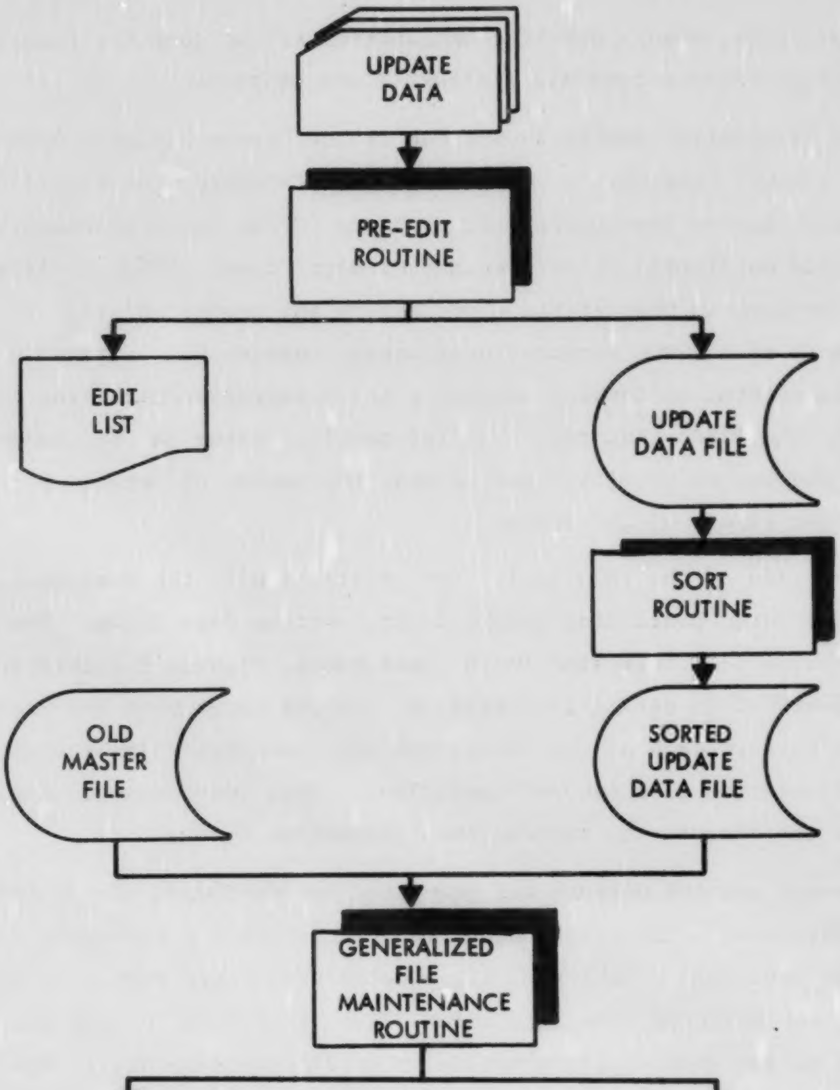
The generalized file maintenance routine merges the sorted input data with the existing master file in the production of a new master file. In this process, records are added, changed, or deleted by the input data.

7.2.3 Data Output

The Information System provides three types of output information: (1) internal computer language outputs directed at the Control Cost Model, Atmospheric Diffusion Model, and Control Strategies Model, (2) a printed listing of the information stored in the various files and (3) a summary output based on pre-programmed report formats. Separate routines are included in the Information System for each of these output functions.

7.3 INFORMATION SYSTEM OPERATIONS

Unlike the Atmospheric Diffusion Models, the Control Cost Model, and the Control Strategies Models, which are computer simulations designed specifically for the Implementation Planning Program, the Information System is a generalized program not unique to the air pollution problem. For this reason the user is provided with a description of the program



UPDATE DATA
PRE-EDIT ROUTINE
EDIT LIST
UPDATE DATA FILE
SORT ROUTINE
OLD MASTER FILE
SORTED UPDATE DATA FILE
GENERALIZED FILE MAINTENANCE ROUTINE
ERROR LIST
NEW MASTER FILE

Figure 7-2. Pre-Edit and Generalized File Maintenance Routines

operations rather than a detailed explanation of the computer program. Appendix B provides a complete listing of the program.

The Information System is written in the Common Business Oriented Language (COBOL) compiler, a computer program language specifically designed for business rather than scientific problems. COBOL has many features which are directly applicable to maintenance of data files. COBOL is like a natural language in that it has a vocabulary and grammar of its own. Under the guidance of a COBOL computer programmer, changes can be made to the Information System by forming sentences and paragraphs describing these changes in the COBOL language. The Information System can be changed to increase the number of fields per record, the number of records per file, or any other aspect of the system.

Operation of the Information System starts with the preparation of IBM punched cards containing inputs to the various data files. The format of these cards is illustrated in the loadsheets, Figures 8-2 through 8-4, and is described in detail in Chapter 8. Having keypunched and verified the input data to each of the files, the user prepares a job-stream card deck configuration as shown in Figure 10-1. This job-stream configuration instructs the computer to execute the Information System.

Several printed outputs are generated in the course of the Information System operations. The first output is a table listing the exact image of each input data card. Table 7-1 illustrates these card images (1 line per card) for the Regional File data input. Each character in this table is identical to the load sheet format shown in Figures 8-2 through 8-4. The purpose of this output is to maintain a record of all file input data.

The second output of the Information System operation is a dictionary list (Table 7-2). The dictionary is a precise description of information used in the editing function performed on input data. Each field of input is identified by a descriptive name such as field "011 COAL C COST POWER PLANT," a unit measure "$/TON" and a set of parameter limits. In this example, the parameter limits indicate that the input value must be numerical (as indicated by the letter "N"), cannot be greater than "1", and cannot be less than ".15." This means that the power plant coal cost input data must be between 15¢ and $1.00 per ton. Every field of input data is specified in

TABLE 7-1. CARD IMAGES

```
                    REGION    FILE
                        INPUT

000      001     3.  E
907      005     8.5 E   006     9.0 E   007     6.0 E   008    10.0 E
907      001     2.59E   002     0.0 E   003     0.0 E   004     0.0 E
907      033     0.0 E   034     7.0 E   035     7.0 E   036     7.0 E
907      029     0.5 E   030     2.0 E   031     1.0 E   032     0.5 E
907      025   152.  E+03026  1000.  E   027     2.0 E   028     1.0 E
907      021    27.  E+06022   29.  E+06023  152.  E+03024  152.  E+03
907      017    6.10E-02018    0.55E-03019    0.44E-03020   27.  E+06
907      013   55.25E-03014    6.9 E-02015    5.71E-02016    7.36E-02
907      009     6.4 E   010    11.95E   011     8.0 E   012    6.67E-02

                    END INPUT LIST
```

TABLE 7-2. DICTIONARY

```
                         REGION    FILE
                      DICTIONARY   LISTING

001  LABOR COST                        $/HR         N  2.00E 00 5.00E 00
002  SALES TAX   A                     PERCENTAGE   N  0.00E 00 1.00E 01
003  SALES TAX   B                     PERCENTAGE   N  0.00E 00 1.00E 01
004  SALES TAX   C                     PERCENTAGE   N  0.00E 00 1.00E 01
005  INTEREST RATE                     PERCENTAGE   N  0.00E 00 1.50E 01
006  COAL A  COST  INDUSTRIAL          $/TON        N  1.00E 00 1.50E 01
007  COAL A  COST  POWER PLANT         $/TON        N  1.00E 00 1.50E 01
008  COAL B  COST  INDUSTRIAL          $/TON        N  1.00E 00 1.50E 01
009  COAL B  COST  POWER PLANT         $/TON        N  1.00E 00 1.50E 01
010  COAL C  COST  INDUSTRIAL          $/TON        N  1.00E 00 1.50E 01
011  COAL C  COST  POWER PLANT         $/TON        N  1.00E 00 1.50E 01
012  OIL A   COST  INDUSTRIAL          $/GAL        N  1.00E-02 2.00E-01
013  OIL A   COST  POWER PLANT         $/GAL        N  1.00E-02 2.00E-01
014  OIL B   COST  INDUSTRIAL          $/GAL        N  1.00E-02 2.00E-01
015  OIL B   COST  POWER PLANT         $/GAL        N  1.00E-02 2.00E-01
016  OIL C   COST  INDUSTRIAL          $/GAL        N  1.00E-02 2.00E-01
017  OIL C   COST  POWER PLANT         $/GAL        N  1.00E-02 2.00E-01
018  GAS COST  INDUSTRIAL              $/CU.FT      N  1.00E-04 1.50E-03
019  GAS COST  POWER PLANT             $/CU.FT      N  1.00E-04 1.50E-03
020  COAL A  HEAT CONTENT              BTU/TON      N  1.00E 07 3.50E 07
021  COAL B  HEAT CONTENT              BTU/TON      N  1.00E 07 3.50E 07
022  COAL C  HEAT CONTENT              BTU/TON      N  1.00E 07 3.50E 07
023  OIL A   HEAT CONTENT              BTU/GAL      N  1.00E 05 2.00E 05
024  OIL B   HEAT CONTENT              BTU/GAL      N  1.00E 05 2.00E 05
025  OIL C   HEAT CONTENT              BTU/GAL      N  1.00E 05 2.00E 05
026  GAS HEAT CONTENT                               N  1.00E 02 1.20E 03
027  COAL A  SULPHUR CON                            N  3.00E-01 3.00E 00
028  COAL B  SULPHUR                                N  3.00E-01 3.00E 00
029  COAL C  SULPH                                     3.00E-01 3.00E 00
030  OIL A   S                                               E-01 3.00E 00
031  OIL B                                                         .00E 00
032
```

the dictionary listing. If the card input data does not match the parameter limits specified by the dictionary, then an editing error message is generated.

The edit error list shown in Table 7-3 may contain any number of errors, depending on the number of input cards that failed to pass the editing function. The error messages are as follows:

MESSAGE	SIGNIFICANCE
"WARNING LIMITS EXCEEDED"	Indicates that the input value for the specified field number has exceeded either the minimum or the maximum value.
"DATA FIELD ERROR"	Indicates an error in the format of the data input (a numeric digit, decimal point or alphabetical character out of place).
"ILLEGAL RECORD KEY - RECORD REJECTED"	Indicates that the record key (made up of the region i.d. and the device i.d.) is not in the required format.
"NO DICTIONARY RECORD FOR THIS DATA"	Indicates that either the field number or the input data is not contained in the edit dictionary. The data is therefore unacceptable as an input to the file.
"DICT/CARD FILE MISMATCH - RECORD REJECTED"	Indicates a mismatch between the dictionary and the input card file being processed.
"NO DICTIONARY IDENTIFICATION RECORD"	Indicates that the first record in the dictionary does not identify the dictionary, and the job is forced to terminate.

An additional output on the edit error list is an edit summary which provides the user with the total number of card inputs, the number of card inputs rejected by the editing functions, and the number of card inputs accepted by the data file.

During the file maintenance procedure, the program merges input information with existing information on the master file. The result of this merging operation is a new master file. Table 7-4 indicates a record of the transactions that took place during the process. The table provides the user with the number of master file records that were processed; the

TABLE 7-3. ERROR LIST

```
 REGION    FILE
EDIT ERROR LISTING

 END ERROR LIST

 EDIT  SUMMARY

CARDS IN            10
CARDS REJECTED       0
CARD RECORDS OUT    10
```

TABLE 7-4. TRANSACTION LIST

```
                    REGION FILE

          UPDATE AND MAINTENANCE SUMMARY


MASTER FILE RECORDS READ IN                         0

TRANSACTICN FILE RECORDS READ IN                   10

MASTER FILE RECORDS OVERLAYED                       0

MASTER FILE RECORDS INSERTED                        2

MASTER FILE RECORDS DELETED                         0

RECORDS ON NEW MASTER FILE                          2
```

number of input records that were processed; and the number of data file additions (inserted records), deletions (removed records), or changes (record overlays).

The final step in the operation of the Information System is preparation of the file listing. Table 7-5 illustrates the output listing of the Region File, which contains all data on the master file in a format designed to assist the user in verifying the file contents.

7.4 DATA FILE SPECIFICATION

Four (4) separate data files contain the air pollution control information required by the Implementation Planning Program. These files, referred to as the SOURCE FILE, the REGIONAL FILE, the METEOROLOGICAL FILE, and the DEVICE FILE, communicate directly with the program models to provide a data base for output reports selected by the user.

The specification for these data files (Tables 7-6 through 7-9) defines: (1) the name of each field within a record, (2) the values assigned to each field, (3) the units in which that value is measured, and (4) the minimum and maximum values established as parameter limits on the data inputs.

In the case of the parameter limits, a careful study was made of typical values, as well as expected extreme values, for the data inputs. The limits were selected according to available engineering estimates. However, it was anticipated that circumstances could arise that would require a change in these limits. In such instances, the user can simply change the particular element in the file dictionary that specifies the limit parameters for the field in question. This change requires a programming modification in the Information System.

7.5 LOADSHEET SPECIFICATION

Loadsheets are the forms by which the user submits data or instructions to the computer. From the loadsheets keypunch operators prepare the IBM punched-cards which are read into the computer. The information contained on these cards provides the program with data for storage in the Information System, or simply with instructions on the specific program options selected by the user. (The loadsheet specifications for program instructions are discussed in Chapter 8).

TABLE 7-5. FILE OUTPUT

```
                                      REGION FILE LISTING                                          FEBRUARY 27, 1970
  --------------------------------------------------------------------------------------------------------------------
  I____REGION___INSTALLATION_TEST_CASE________________________________________________________________________________I
LABOR COST                  00002.59E 00    SALES TAX   A                00000.00E 00    SALES TAX   B                00000.00E 00
SALES TAX   C               00000.00E 00    INTEREST RATE                00008.50E 00    COAL A  COST  INDUSTRIAL     00009.00E 00
COAL A  COST  POWER PLANT   00006.00E 00    COAL B  COST  INDUSTRIAL     00010.00E 00    COAL B  COST  POWER PLANT    00006.40E 00
COAL C  COST  INDUSTRIAL    00011.95E 00    COAL C  COST  POWER PLANT    00008.00E 00    OIL A   COST  INDUSTRIAL     00006.67E-02
OIL A   COST  POWER PLANT   00055.25E-03    OIL B   COST  INDUSTRIAL     00006.90E-02    OIL B   COST  POWER PLANT    00005.71E-02
OIL C   COST  INDUSTRIAL    00007.36E-02    OIL C   COST  POWER PLANT    00006.10E-02    GAS COST  INDUSTRIAL         00000.55E-03
GAS COST  POWER PLANT       00000.44E-03    COAL A  HEAT CONTENT         00027.00E+06    COAL B  HEAT CONTENT         00027.00E+06
COAL C  HEAT CONTENT        00029.00E+06    OIL A   HEAT CONTENT         00152.00E+03    OIL B   HEAT CONTENT         00152.00E+03
OIL C   HEAT CONTENT        00152.00E+03    GAS HEAT CONTENT             01000.00E 00    COAL A  SULPHUR CONTENT      00002.00E 00
COAL B  SULPHUR CONTENT     00001.00E 00    COAL C  SULPHUR CONTENT      00000.50E 00    OIL A   SULPHUR CONTENT      00002.00E 00
OIL B   SULPHUR CONTENT     00001.00E 00    OIL C   SULPHUR CONTENT      00000.50E 00    GAS SULPHUR CONTENT          00000.00E 00
COAL A  ASH CONTENT         00007.00E 00    COAL B  ASH CONTENT          00007.00E 00    COAL C  ASH CONTENT          00007.00E 00
```

TABLE 7-6. SOURCE FILE SPECIFICATIONS

FIELD NAME	DESCRIPTION	UNITS	PARAMETER LIMITS	
			MINIMUM	MAXIMUM
Source Identification	A number assigned to each source in the region. The first four digits are the SIC code. The next three digits are a site code which the user develops for the region. The last digit identifies a combustion source (0) or a process source (1-9) at the site. The process source number allows the identification of different air pollution contributors at the given source location (i.e., a steel mill might include open hearth furnace, basic oxygen furnace, etc.). The process source number must be consistent for all sources within a SIC classification.	----	8 code digits	8 code digits
Source Descriptive Name	A word description of the type of air pollution source being considered.	----	0 characters	24 characters
Location X	Distance from a North-South line through the westernmost point in the region to the source's location. For a point source, this location is the location of the source; for an area source, this is the centroid or southwest corner of the area.	kilometers	0	500
Location Y	Distance from an East-West line through the southernmost point in the region to the point described above.	kilometers	0	500
Area	The area of an area source.	square kilometers	0	15,000
Political Jurisdiction	A numerical designation of the jurisdiction in which the source is located.	----	1 code digit	2 code digits
Ownership	Signifies the ownership of the source.	P = private L = Local Gov't S = State Gov't F = Federal Gov't U = Utility	1 character	1 character
Source Type	Defines the process.	B = Furnace P = Manufacturing S = Incineration	1 character	1 character
Stack Height	Height of existing stack above grade.	meters	0	500
Stack Diameter	Inside diameter of the stack at its exit.	meters	0	15

TABLE 7-6. SOURCE FILE SPECIFICATIONS (Continued)

FIELD NAME	DESCRIPTION	UNITS	PARAMETER LIMITS	
			MINIMUM	MAXIMUM
Original Gas Sulfur Content	Sulfur content of a combustion source's present gas.	%	0	1
Electricity Cost	Price a source pays for electricity.	$/KwHr	0	0.05
Device Fuel Cost	Price of fuel required to operate a control device (e.g., an afterburner).	$/cu. ft.	0	0.0015
Liquid Cost - SO_2	Price of liquid required to operate a control device (e.g., a wet scrubber).	$/gal.	0.0001	0.0003
Disposal Factor - SO_2	An amount to be added to Disposal Cost or Credit, SO_2, in the Device File to compensate for individual plant peculiarities.	$/ton	-5.0	+5.0
Disposal Factor - CO	An amount to be added to Disposal Cost or Credit, CO, in the Device File to compensate for individual plant peculiarities.	$/ton	-5.0	+5.0
Disposal Factor - Particulate	An amount to be added to Disposal Cost or Credit, particulate, in the Device File to compensate for individual plant peculiarities.	$/ton	-5.0	+5.0
Manufacturing Process Units	Defines process rate units for manufacturing sources. If left "␣",this field indicates process units in lb./day.	T = Tons A = Barrels of oil U = Bushels C = Barrels of cement	1 character	1 character
Coal Rate Annual	Annual average rate of coal consumption.	Tons/day	0	100,000
Oil Rate Annual	Annual average rate of oil consumption.	Gal./day	0	1,500,000
Gas Rate Annual	Annual average rate of gas consumption.	Cu. ft./day	0	170,000,000
Process Material Rate Annual*	Annual average material process rate.	Process units/day	0	----
Emission Rate SO_2 - Summer	Average rate of SO_2 emission to the atmosphere during the summer.**	Tons/day	0	1000
Emission Rate SO_2 - Winter	Average rate of SO_2 emission to the atmosphere during the winter.	Tons/day	0	1000
Emission Rate SO_2 - Annual	Annual average rate of SO_2 emission to the atmosphere.	Tons/day	0	1000

* The maximum parameter limits are dependent on the process material and source type.

**All emission rates represent total emissions from a given source, i.e., several stacks at a given site are combined for a total emission rate.

TABLE 7-6. SOURCE FILE SPECIFICATIONS (Continued)

FIELD NAME	DESCRIPTION	UNITS	PARAMETER LIMITS	
			MINIMUM	MAXIMUM
Exit Velocity	Velocity of the gas leaving the stack at actual conditions.	meter/sec.	0	25
Exit Temperature	Temperature of the gas leaving the stack.	°Kelvin	300	1000
Existing Control Device	Coded identification of air pollution control measures which are currently in effect at the site. In the case of multiple controls use last device.	----	3 digits	3 digits
Existing SO_2 Control Efficiency	Efficiency of the existing device(s) for controlling SO_2 emissions.	%*	0	100
Existing CO Control Efficiency	Efficiency of the existing device(s) for controlling CO emissions.	%	0	100
Existing Particulate Control Efficiency	Efficiency of the existing device(s) for controlling particulate emissions.	%	0	100
Exhaust Gas Volume	Amount of gas leaving the stack at exit temperature.	ACFM	0	3,000,000
Rated Capacity	Maximum rated capacity of a combustion source.	BTU/Hr	0	1×10^{11}
Operating Time	Amount of time the industrial process or combustion source is in operation.	Hrs/Yr	0	8760
Annual Shifts	Annual average number of shifts worked.	shifts/day	0	3
Original** Coal Cost	Amount paid by a combustion source for coal.	$/ton	0	25
Original Oil Cost	Amount paid by a combustion source for oil.	$/gal.	0	0.20
Original Gas Cost	Amount paid by a combustion source for gas.	$/cu. ft.	0	0.0015
Original Coal Heat Content	Heat content of a combustion source's present coal.	BTU/ton	0	35,000,000
Original Oil Heat Content	Heat content of a combustion source's present oil.	BTU/gal.	0	200,000
Original Gas Heat Content	Heat content of a combustion source's present gas.	BTU/cu. ft.	0	1200
Original Coal Sulfur Content	Sulfur content of a combustion source's present coal.	%	0	10
Original Oil Sulfur Content	Sulfur content of a combustion source's present oil.	%	0	5

* Ratio of the amount removed to the amount entering the collection device expressed as a percentage.
**The term "original" refers to the fuel in use prior to a fuel substitution or fuel switch.

TABLE 7-6. SOURCE FILE SPECIFICATIONS (Continued)

FIELD NAME	DESCRIPTION	UNITS	PARAMETER LIMITS	
			MINIMUM	MAXIMUM
Emission Rate CO - Summer	Average rate of CO emission to the atmosphere during the summer.	Tons/day	0	1000
Emission Rate CO - Winter	Average rate of CO emission to the atmosphere during the winter.	Tons/day	0	1000
Emission Rate CO - Annual	Annual average rate of CO emission to the atmosphere.	Tons/day	0	1000
Emission Rate Particulate - Summer	Average rate of particulate emission to the atmosphere during the summer.	Tons/day	0	1000
Emission Rate Particulate - Winter	Average rate of particulate emission to the atmosphere during the winter.	Tons/day	0	1000
Emission Rate Particulate - Annual	Annual average rate of particulate emission to the atmosphere.	Tons/day	0	1000

TABLE 7-7. CONTROL DEVICE FILE SPECIFICATIONS

FIELD NAME	DESCRIPTION	UNITS	PARAMETER LIMITS	
			MINIMUM	MAXIMUM
Device Identification	Coded identification of the new control device.	----	3 digits	3 digits
Device Name	Word description of the device.	----	No characters	24 characters
Manufacturer's Price Coefficient #1	Numerical constant in Manufacturer's Price Equations.	----	-10	+100
Manufacturer's Price Coefficient #2	Numerical coefficient of X in Manufacturer's Price Equations.	----	-10	+150
Manufacturer's Price Coefficient #3	Numerical coefficient of X^2 in Manufacturer's Price Equations.	----	-10	+1
Total Installation Cost Factor	This is an installation factor based on the costs of delivery, erection, architecture and engineering, utilities, loss of production, spare parts, added space, etc.	%*	0	500
Life	Number of years over which the equipment is depreciated.	Years	0	30
Pressure Drop	Amount of pressure required to force the exhaust gas through the device.	in. H_2O	0	80
Labor Quantity - Small Plant	Amount of labor required to operate and maintain the device at a plant having less than 40,000 ACFM exhaust gas volume.	hours of labor per hour of operation	0	1
Labor Quantity - Medium Plant	Amount of labor required to operate and maintain the device at a plant having 40,000 - 250,000 ACFM exhaust gas volume.	hours of labor per hour of operation	0	3
Labor Quantity - Large Plant	Amount of labor required to operate and maintain the device at a plant having 250,000-1,000,000 ACFM exhaust gas volume.	hours of labor per hour of operation	0.5	5
Labor Quantity - Extra Large Plant	Amount of labor required to operate and maintain the device at a plant having more than 1,000,000 ACFM exhaust gas volume.	hours of labor per hour of operation	1	10
Chemical Cost	Price of chemicals required to operate a chemical reaction type control device.	$/ton	0	--**
Disposal Cost or Credit - SO_2	Cost of disposal or credit for the sale of collected SO_2.	$/ton	-5	+50

* Ratio of item cost to device purchase price, expressed as a percentage.
** Maximum limits to be determined by the specific chemical required.

TABLE 7-7. CONTROL DEVICE FILE SPECIFICATIONS (Continued)

FIELD NAME	DESCRIPTION	UNITS	PARAMETER LIMITS	
			MINIMUM	MAXIMUM
Disposal Cost or Credit - CO	Cost of disposal or credit for the sale of collected CO.	$/ton	0	40
Disposal Cost or Credit - Particulate	Cost of disposal or credit for the sale of collected particulate.	$/ton	-0.5	+5
Device Fuel Factor	A factor to be applied to the computed device fuel quantity to allow for individual device differences.	Dimensionless	0	1.2
Rated Efficiency - SO_2	Basic device efficiency for removal of SO_2, as stated by the manufacturer.	%	0	100
Rated Efficiency - CO	Basic device efficiency for removal of CO, as stated by the manufacturer.	%	0	100
Rated Efficiency - Particulate	Basic device efficiency for removal of particulates, as stated by the manufacturer.	%	0	100

TABLE 7-8. REGIONAL FILE SPECIFICATIONS

FIELD NAME	DESCRIPTION	UNITS	PARAMETER LIMITS	
			MINIMUM	MAXIMUM
Labor Cost	Regional average wage for unskilled labor. If a particular device requires a different class of labor, the Labor Quantity input (Device File) may be adjusted proportionally.	$/hr	2	5
Sales Tax A	Sales tax rate for specified political jurisdictions.	%	0	10
Sales Tax B	Sales tax rate for specified political jurisdictions.	%	0	10
Sales Tax C	Sales tax rate for specified political jurisdictions.	%	0	10
Interest Rate	Rate on money to purchase a control device.	%	0	15
Coal A* Cost - Industrial	Regional price for Coal A paid by industrial sources.	$/ton	1	15
Coal A Cost - Power Plants	Regional price for Coal A paid by power plants.	$/ton	1	15
Coal B Cost - Industrial	Regional price for Coal B paid by industrial sources.	$/ton	1	15
Coal B Cost - Power Plants	Regional price for Coal B paid by power plants.	$/ton	1	15
Coal C Cost - Industrial	Regional price for Coal C paid by industrial sources.	$/ton	1	15
Coal C Cost - Power Plants	Regional price for Coal C paid by power plants.	$/ton	1	15
Oil A Cost - Industrial	Regional price for Oil A paid by industrial sources.	$/gal.	0.01	0.20
Oil A Cost - Power Plants	Regional price for Oil A paid by power plants.	$/gal.	0.01	0.20
Oil B Cost - Industrial	Regional price for Oil B paid by industrial sources.	$/gal.	0.01	0.20
Oil B Cost - Power Plants	Regional price for Oil B paid by power plants.	$/gal.	0.01	0.20
Oil C Cost - Industrial	Regional price for Oil C paid by industrial sources.	$/gal.	0.01	0.20
Oil C Cost - Power Plants	Regional price for Oil C paid by power plants.	$/gal.	0.01	0.20
Gas Cost - Industrial	Cost of natural gas to industrial sources.	$/cu. ft.	0.0001	0.0015
Gas Cost - Power Plants	Cost of natural gas to power plants.	$/cu. ft.	0.0001	0.0015
Coal A - Heat Content	Heat content of Coal A.	BTU/ton	10,000,000	35,000,000

*Letters indicate grade of fuel. To distinguish fuel grades note the specifications for heat content, sulfur content, and ash content.

TABLE 7-8. REGIONAL FILE SPECIFICATIONS (Continued)

FIELD NAME	DESCRIPTION	UNITS	PARAMETER LIMITS	
			MINIMUM	MAXIMUM
Coal B - Heat Content	Heat content of Coal B.	BTU/ton	10,000,000	35,000,000
Coal C - Heat Content	Heat content of Coal C.	BTU/ton	10,000,000	35,000,000
Oil A - Heat Content	Heat content of Oil A.	BTU/gal.	100,000	200,000
Oil B - Heat Content	Heat content of Oil B.	BTU/gal.	100,000	200,000
Oil C - Heat Content	Heat content of Oil C.	BTU/gal.	100,000	200,000
Gas Heat Content	Heat content of natural gas available in the region.	BTU/gal.	800	1200
Coal A - Sulfur Content	Sulfur content of Coal A.	%*	0.30	3.0
Coal B - Sulfur Content	Sulfur content of Coal B.	%	0.30	3.0
Coal C - Sulfur Content	Sulfur content of Coal C.	%	0.30	3.0
Oil A - Sulfur Content	Sulfur content of Oil A.	%	0.30	3.0
Oil B - Sulfur Content	Sulfur content of Oil B.	%	0.30	3.0
Oil C - Sulfur Content	Sulfur content of Oil C.	%	0.30	3.0
Gas Sulfur Content	Sulfur content of natural gas.	%	0	1.0
Coal A - Ash Content	Ash content of Coal A.	%	1	20
Coal B - Ash Content	Ash content of Coal B.	%	1	20
Coal C - Ash Content	Ash content of Coal C.	%	1	20

* Weight ratio expressed as a percentage.

TABLE 7-9. METEOROLOGICAL FILE SPECIFICATIONS

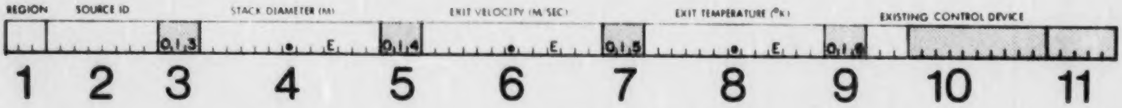
FIELD NAME	DESCRIPTION	UNITS	PARAMETER LIMITS	
			MINIMUM	MAXIMUM
Variable Stability Wind Rose Data*	Relative frequency of occurrence for each combination of the 16 wind directions, 6 wind speeds and 5 stabilities; a total of 480 values.	Dimensionless	0	1.0
Neutral Stability Wind Rose Data*	Relative frequency of occurrence for each wind direction, divided by the effective wind speed for that direction. There are 16 values in this data set.	Dimensionless	.01	100
Effective Wind Speed**	Effective wind speed for each of the 16 wind directions.	meters/second	.01	100
Mixing Depth	Annual average afternoon distance between the ground and the base of the stable layer aloft.	meters	100	9000
Ambient Temperature	Annual regional average atmospheric temperature.	Degrees Kelvin	0	3500
Ambient Pressure	Annual regional average atmospheric pressure.	millibars	0	1500

* IPP can be run using either the neutral stability or the variable stability wind rose data.
**Required only if neutral stability wind rose data is used.

7.5.1 Disk Memory Files

The loadsheets shown in Figures 8-2 through 8-5 represent the data input format for: (1) the SOURCE FILE, containing all the source emission inventory information; (2) the DEVICE FILE, containing all the information on control devices and non-device control measures; and (3) the REGIONAL FILE, containing specific parameters uniquely associated with an air quality control region, such as sales tax or interest rates.

For each of the files, the loadsheet represents an 80-column punched-card layout with specific areas of the card allocated to the input information. For instance, in the following example the 80 columns are divided into eleven (11) fields. Each field is designated as the location for a specific piece of input information to the program.



FIELD	DESCRIPTION
1	The first field, labeled REGION, is a space reserved for a 3-digit designation of the specific air quality control region.
2	The second field is reserved for a SOURCE ID which specifies a 4-digit Standard Industrial Classification (SIC) code, a 3-digit site location, and a 1-digit sub-classification for the SIC code.
3,5,7,9	The third, fifth, seventh, and ninth fields represent four spaces, each of 3 digits, for the purpose of numbering the fields. The actual field numbers are pre-printed on the loadsheet and require no additional inputs from the user. The shading on these fields is to warn the user against entering data in these columns. The keypunch

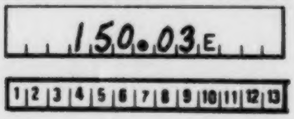
FIELD | DESCRIPTION

operator will automatically punch the field numbers pre-printed on the loadsheet.

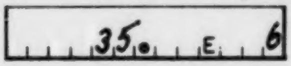
4,6,8

Fields four, six, and eight are reserved for numeric data describing the characteristics of a source in terms of the STACK DIAMETER, EXIT VELOCITY, and EXIT TEMPERATURE. For these three fields, an exponential format is used to describe an arithmetic value. The exponential format used in the preparation of numeric data on the loadsheets appears as follows:

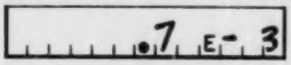
for a value of 150.03



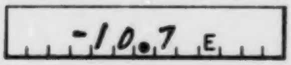
for a value of 35,000,000



for a value of 0.0007



for a value of -10.7



The sign following the letter E, Column 11, indicates the direction in which the decimal point is shifted. The two digits following the sign, Columns 12 and 13, indicate how many places to shift the decimal point. If less than two digits are needed, the number must always be right-justified, e.g., a one-digit shift must appear in Column 13. Incidently, in the second and third examples above, the user is permitted the option of writing 0.35 E 8 to express the value 35,000,000, as

FIELD	DESCRIPTION
	well as 3.5 E 7. It follows, then, that he may use -1.07 E 1 and -107 E -1 to express the value -10.7. The pre-printed decimal point and the letter E are to remind and guide the user in preparing arithmetic data in exponential form. Any blank columns in this format will be treated as either a "zero" or a "plus" sign. Both Columns 1 and 11 are reserved for the sign of the value and exponent respectively. All other columns are reserved for numeric characters.
10	The tenth field is reserved for a code describing the EXISTING CONTROL DEVICE. In this example, the code has a 3-digit numeric format. Therefore, the remaining 10 columns of a normal numeric field are shaded in as a warning not to enter data in these columns. In some instances, the code may be alphabetic, in which case the letters are entered on the loadsheets. The distinguishing characteristic between arithmetic values and codes (numeric or alphabetic) is the presence or absence of the decimal point and the letter E. Both the decimal point and the E are required for the arithmetic values.
11	The eleventh field is left blank by the user, as indicated by the shading. Normally, these last five columns of a punched card are reserved for a sequence code which is automatically punched after all the cards have been keypunched. In the event that the card deck is in some way physically disturbed, its normal order can be automatically reestablished by means of the sequence code.

7.5.2 Punched-Card Files

The METEOROLOGY FILE contains the necessary meteorological information for calculating the atmospheric diffusion process. This file is maintained on IBM punched cards rather than in the disk memory, for several reasons:

(a) The Atmospheric Diffusion Model requires more frequent changes in the meteorological data. For example, during verification of the Atmospheric Diffusion Model, several sets of air quality data (for different recording periods or sampling stations) may be used.

(b) A great deal of meteorological information is presently available in punched-card form from NAPCA's designation of air quality control regions.

(c) Various elements of the model may require modification to suit the needs of a local meteorologist in an attempt to calibrate the model for a given region. These changes may require alterations to the program coding. To facilitate this possibility, the many parameters in the program have been designated in the NAMELIST* form, which presently requires the use of punched-card input.

7.6 REPORT GENERATION

The Information System provides the storage and retrieval functions necessary to supply data to the three basic models of the Implementation Planning Program -- the Atmospheric Diffusion, Control Cost-Effectiveness, and Control Strategy Models. After operating on these data, each of the models generates specific output information for the user. Aside from this, the Information System also provides output information simply on the basis of the data stored in the files. This report generation function has a limitless flexibility when retrieving selected records, sequencing these records, creating presentation formats for these records, and providing summary tabulations of selected fields within the records.

Several useful report generation routines have been prepared as a part of the Information System. The format of these report outputs is shown in Tables 7-10 through 7-12. Since the variability in these outputs is unlimited, no attempt has been made to exhaust all the possible types of formats. The user is encouraged to specify the report format best suited to his needs and have the appropriate COBOL program written to provide a

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*NAMELIST is a FORTRAN compiler feature referring to variables used in input/output statements and normal processing statements.

TABLE 7-10. POLLUTANT EMISSIONS

POLLUTANT EMISSIONS BY SOURCE CATEGORY (TONS/YEAR)
INSTALLATION TEST CASE
FEBRUARY 18, 1970

POLLUTANT	POLITICAL JURISDICTION	FUEL COMBUSTION	INDUSTRIAL PROCESS	WASTE DISPOSAL	TOTAL
SO2	1	126977	93512	218	220707
SO2	2	321598	17774	0	339372
	TOTAL	448575	111286	218	560079
PARTICULATE	1	0	48542	0	48542
PARTICULATE	2	0	10910	0	10910
	TOTAL	0	59452	0	59452

TABLE 7-11. CONTROLLED VERSUS UNCONTROLLED SOURCES

NUMBER OF CONTROLLED AND UNCONTROLLED SOURCES BY SOURCE CATEGORY
ST. LOUIS
MARCH 1, 1970

POLITICAL JURISDICTION	COMBUSTION		INDUSTRIAL		WASTE	
	C	UC	C	UC	C	UC
1	3		3	4		1
2	3	2	6	1		
TOTAL	6	2	9	5		1

TABLE 7-12. COMBUSTION SOURCES

NUMBER OF COMBUSTION SOURCES BY SULFUR CONTENT OF FUEL
ST. LOUIS
MARCH 1, 1970

POLITICAL JURISDICTION	UNDER 0.5%	OVER 0.5% UNDER 1%	OVER 1% UNDER 2%	OVER 2%
1				4
2				5
TOTAL				9

specific output report. Since the Information System is based on a sequential file with fixed-length records and fixed-length fields for each of the files, the task of preparing programs for output reports is greatly simplified. Each of these additional routines can be appended to the main program, as shown in the program input preparation section of Chapter 8.

8.0 PREPARATION OF INPUT DATA

To operate the Implementation Planning Program, several types of input data must be prepared for the computer. The description of this data is based on an example referred to as the "Installation Test Case." The geographic features of the Test Case are those of the St. Louis Air Quality Control Region. This region is divided into two major political subdivisions (located in Missouri and Illinois , respectively), each requiring air pollution control strategies to form separate implementation plans. Realistic data is presented in the Test Case for emission inventory, meteorological, and air quality information. However, to limit the size of the Test Case, only a small sampling of data is used. Figure 8-1 illustrates the boundaries of the St. Louis Air Quality Control Region, as well as the location and type of major point sources of pollution.

There are four types of punched-card input data which must be prepared for operation of the Implementation Planning Program. These are:

(1) Fixed-format disk memory data file information

(2) Namelist* program information

(3) Fixed-format program information, and

(4) Job Control Language inputs used to control program operations.

These formats are defined as follows:

(a) Fixed-Format inputs require the user to locate input data exactly as specified in the instructions. The instructions include column numbers and the exact form of the input data required. Computer loadsheets with the Installation Test Case data are provided as a guide to the user.

(b) Namelist inputs allow the user a free-form flexibility in locating input data between columns 2 and 80 of the punched card. The user is instructed to provide the name of the variable, followed by an equal sign and then the single or multiple values of the variable. If multiple values are associated with a variable, then each value must be followed by a comma. The number of values associated with a variable must never exceed the maximum number specified in the instructions. If repetitive values are encountered while preparing the input data, a special format can be used which specifies the number of repetitions and the value of the variable. For example, the format 100*7 represents one hundred entries of the value 7. The number of value entries per punched card is left up to the user, but with the stipulation that each value (including the last value entered) must be followed by a comma.

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*"Namelist" is an input format option in the Fortran language.

Three input modes are used in the Namelist format:

Floating Point -	A decimal point can appear anywhere in the field used for the value. A field is defined as the number of columns between commas or between the equals sign and the first comma. A comma must separate multiple values and must follow the last value. The values may also be expressed in exponential form, with a number such as 100 input as .100E3.
Integer -	No decimal points are used. The comma separating values or ending a string of values must immediately follow the last digit of a value. The values must be right-justified with respect to the commas.
Alphabetic -	All alphabetic values must be enclosed in single quotes and must be followed immediately by a comma.

(c) Job Control Language inputs are used to control the operation of the program and to specify certain computing facility characteristics. The user is encouraged to coordinate the preparation of these punched cards with the systems programmers assigned to the computing facility. The Job Control Language inputs are shown in the actual form prepared for the TRW Systems computing facility (an IBM 360/40 computer operating under OS Release 18).

A coded format is used in describing the preparation of namelist and fixed-format punched-card inputs. This includes a code designation and a description of the actual input data. The code is as follows:

O - Data is optional and is not required for program operation.

M - Data is mandatory and is required for program operation.

N - Data is in the namelist format.

P - Floating point mode.

I - Integer mode.

A - Alphabetic mode.

F - Data is in the fixed format.

The description of the input data explains the type of data required and the results to be expected if data is omitted. Neither the code nor the description is punched on cards; it is merely a guide to the user. The input preparations starting in Section 8.2 use this instruction format.

8.1 INFORMATION SYSTEM - PUNCHED CARD INPUTS

8.1.1 Data File Loadsheet Inputs

The disk memory data file contains the emission inventory, control device list, and specific regional data. The file is loaded via the Information System described in Chapter 7, using the loadsheets illustrated in Figures 8-2 through 8-4. Each item on these loadsheets is described in the Data Specification Tables (7-6 through 7-19). The exact alphabetic and numeric format to be used in filling out these loadsheets is discussed in Section 7.5. Additional instructions for filling out the loadsheets are provided in the following outline.

A. Instructions for Filling Out Implementation Planning Program Source File Loadsheets

1. Point Sources - For items not applicable to a given source, leave positions blank.

(001)* Region -

a. As shown in Appendix D and the Guidelines Document, pg. 39, i.e., Washington, D.C. - 001; Cincinnati-009, St Louis -007. The Installation Test Case is based on St. Louis data and is identified as 907.

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*Field numbers are used to identify locations on the loadsheets (Figures 8-2 through 8-4).

(001) Source ID -

a. The first four digits (left to right) are the SIC code. When a source does not fit one of the categories listed below, the SIC code must be determined from the SIC Classification Manual (1957; Supplement, 1963).

b. The next three digits (left to right) are for site identification (ranging from 001 to 999, depending on the number of point sources of emission having a given SIC code).

c. For the last digit, zero (0) is used to identify an emission source, and 1-9 are used for identification of specific processes. At present, 1 is used for all sources except those listed below (also use 1 for solid waste disposal).

SIC CODE - INDUSTRIAL PROCESS

2819 - Acid Manufacturing
1. Sulfuric acid
2. Nitric acid
3. Ammonium nitrate

3312 - Iron and Steel Mills
1. Blast furnace
2. Basic oxygen furnace
3. Sintering
4. Coking operations
5. Electric arc furnace
6. Open hearth furnaces
7. Bessemer
8. Scarfing

3332 - Lead Smelters
1. Sintering
2. Blast furnace
3. Reverberatory furnace

3274 - Lime Production
1. Rotary kiln
2. Vertical kiln

3295 - Rock, Sand and Gravel
1. Crushing
2. Conveying, screening & shaking
3. Storage piles

2911 - Petroleum Refinery
1. Fluid catalytic units
2. Moving bed catalytic units
3. Sulfur recovery

2621 - Kraft Pulp Mill
  1. Digester blow system
  2. Smelt tank
  3. Lime kiln
  4. Recovery furnace
  5. Evaporator
  6. Oxidation tower

2851 - Paint and Varnish
  1. Varnish cookers
  2. Alkyresin
  3. Cooking & blowing
  4. Polymerization

2099 - Coffee Roasting
  1. Direct fired
  2. Indirect fired
  3. Stones & cooler
  4. Spray dryer

2040 - Feed & Grain
  1. General
  2. Wheat
  3. Alfalfa
  4. Barley flour mill
  5. Orange pulp

3361 - Secondary Aluminum Operations
  1. Chlorination station
  2. Crucible furnace
  3. Reverberatory furnace
  4. Sweating furnace

3362 - Secondary Brass & Bronze
  1. Crucible furnace
  2. Electric furnace
  3. Reverberatory furnace
  4. Rotary furnace

3321 - Grey Iron Foundries
  1. Cupola
  2. Electric induction
  3. Reverberatory furnace

3363 - Lead Foundry
  1. Cupola
  2. Pot furnace
  3. Reverberatory and sweating

3323 - Steel Foundries
  1. Electric arc
  2. Electric induction
  3. Open hearth

3364 - Zinc Foundry
1. Galvanizing kettles
2. Calcine kilns
3. Pot furnaces
4. Sweating furnace

2819 - Calcium Carbide
1. Coke dryer
2. Electric furnace hood
3. Electric furnace vents
4. Stack

3241 - Cement Manufacturing
1. Dry process
2. Wet process

(002) Source Descriptive Name

a. Brief source name (abbreviated), plus brief description of source type.

(003 & 004) Location of X & Y

a. Grid coordinate location of source (to the nearest tenth of a kilometer when using UTM system).

(008) Political Jurisdiction

a. List and code all political jurisdictions to which different regulations will be applied. Each point source is then identified in the appropriate jurisdiction.

(009) Ownership

P - Private
L - Local Government
S - State Government
F - Federal Government
U - Utility

(010) Source Type

B - Fuel Combustion
P - Industrial Process
S - Solid Waste Disposal

(012) Stack Height (meters)

a. Multiply height in feet by 0.3048 to obtain height in meters.

(013) Stack Diameter (meters)

a. Multiply diameter in feet by 0.3048 to obtain diameter in meters.

(014) Exit Velocity (meters/sec)

a. Multiply velocity in feet/sec by 0.3048 to obtain velocity in meters/sec.

b. Should be velocity at source capacity or maximum operating conditions, whichever is greater.

(015) Exit Temperature (^{o}K)

a. If in ^{o}C, add 273^{o}

b. If in ^{o}F, subtract 32^{o}, multiply by 5/9, and add 273^{o}.

(016) Existing Control Device

a. Use code shown in Table 5-1.

(017-019) Existing Control Efficiency

a. In most cases only particulate control efficiency will be listed.

b. The efficiency should be listed as a percent (e.g., 90.5%).

(021) Exhaust Gas Volume

a. Either given or calculated from the following equation:

$$\text{Volume (ft}^3\text{/min)} = 60 \text{ (sec/min)} \cdot \text{Velocity (ft/sec)} \cdot \pi/4 \text{ (Diameter)}^2 \text{ (ft}^2\text{)}$$

b. Data should be for plant capacity or maximum operating rate, whichever is greater.

(022) Rated Capacity (BTU/hr)

a. Actual rated capacity or maximum operating capacity, whichever is greater.

(023) Operating Time (hr/yr)

(026) Annual Shifts (shifts/day)

a. Calculate as follows:

$$\frac{\text{(Operating Time, hr/yr)}}{\text{(8 hr/shift)} \cdot \text{(365 days/yr)}}$$

b. Reported to the nearest tenth

(027-029) Original Fuel Costs

a. Use information obtained for each fuel combustion source.

b. If unavailable, enter a figure which is an average for the entire region.

(030-032) Fuel Heat Content

a. If available, list for each individual combustion source.

b. If not available for each source, enter an average number for the region.

c. Should not be left blank for fuel type in use.

(036-041) Cost Data

a. If available, use average figures for region.

(043) Manufacturing Process Units

T = Tons/day

A = Barrels of Petroleum/day

U = Bushels/day

C = Barrels of concrete/day

L = Pounds/hr

(046, 049 & 052) Annual Fuel Rates

(055) Annual Process Rate (lb/hr)

a. Enter average actual capacity or maximum operating rate of process weight, whichever is available.

(035) Original Gas Sulfur Content (%)

a. Leave blank unless process gas has a high sulfur content.

b. Enter as percent (e.g., 0.5%).

(056-057) Same as (058) for summer and winter seasons.

(058) Annual SO_2 Rate (tons/day)

a. Annual emissions divided by 365.

(059-060)* Same as (061) for summer and winter seasons.

(061) Annual CO rate (tons/day)

(062-063) Same as (064) for summer and winter seasons.

(064) Annual Particulate Rate (tons/day)

a. Annual emissions divided by 365.

(033-034) Coal & Fuel Oil Sulfur Content (%)

a. Enter as percent (e.g., 2.3%).

2. Area Sources

(001) Region -

a. Same as point sources.

(001) Source ID -

a. First four digits are 9999.

b. Leave other digits blank.

(002) Source Descriptive Name

a. Leave blank or select a brief name for area.

(003 & 004) Location X & Y

a. Lower left hand corner of grid.

(005) Area

a. Area of grid

(056-057) Same as (058) for summer and winter seasons.

(058) Annual SO_2 Rate (tons/day)

a. Annual emissions divided by 365.

(059-060)* Same as (061) for summer and winter seasons.

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*Fields (059-061) have been provided for future expansion of the program.

(061) Annual CO rate (tons/day)

(062-063) Same as (064) for summer and winter seasons.

(064) Annual Particulate Rate (tons/day)

a. Annual emission divided by 365

(008) Political Jurisdictions

a. Code number for jurisdiction in which the grid is located. A code is required for each jurisdiction to which a different regulation will be applied.

b. If an area source lies in two or more jurisdictions, separate area source inputs (Section A-2) must be provided.

(012) Stack Height (meters)

a. Average stack height of area source emissions in a given grid.

b. Value can vary throughout the region, depending on the type of area sources in a given grid.

B. Instructions for Filling out Implementation Planning Program Device File Loadsheets

(001-002) Device Name - A descriptive name (see Table 5-1) to identify the control device (i.e., wet scrubber, high efficiency).

(003-005) Manufacturer's Price Coefficient - These numbers are used to relate the purchase cost of the control device to some significant parameter measuring source size. (See Table 5-4 and Control Techniques Documents.)

(014) Total Installation Cost Factor. All factors which influence the installation of a device should be considered in preparing this percentage factor. (Note: for certain devices involving considerable plant modifications, purchase and installation costs cannot be separately identified. In these cases, the total installed cost is given by the purchase price equation and the installed cost factor is omitted.)

(015) Life - In accounting terms, this represents the period over which the device cost may be depreciated or the useful life of the equipment.

(016) Pressure Drop - The loss of static pressure head, in inches of water, of a gas stream passing through the device.

(017-020) Labor Quantity - The figures represent the average number of man-hours of labor per hour of operation required to sustain the device for various sizes of pollution source. These numbers should reflect actual operating experience with the control device, if available.

(021) Chemical Cost - This cost should reflect average delivery and preparation charges as well as the base chemical prices.

(022-024) Disposal Costs - The cost or credit resulting from disposal of collected pollutants must be specified. Two basic factors should be considered when defining these costs:

1. The form in which the pollutant is collected by the control device (i.e., wet, dry, or type of by-product produced.)
2. Regional demand for the saleable collected pollutants, or availability of dumping areas for waste material.

(026) Device Fuel Factor - This field is used only for afterburner-type control devices. The fuel factor relates the amount of fuel required by a device to the amount used by a direct flame afterburner treating the same exhaust gas volume.

(027-029) Rated Efficiencies - The design or rated efficiency must be provided for each air pollutant removed or collected by the control device. This efficiency may be adjusted in the Cost Model to account for particular source conditions.

C. Instructions for Filling out Implementation Planning Program Regional File Loadsheets

(001) Labor Cost - The information can be obtained from statistical abstracts prepared by the Labor Department. (Note: the labor quantities given for each specific device reflect the amounts of skilled or supervisory labor required so that the total operating cost may be determined on the unskilled labor cost basis.)

(002-004) Sales Tax - These figures are available from the significant political jurisdictions within the region (generally the states). The A, B, and C refer to three major jurisdictions within a region having separate tax rates.*

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*This input has been provided for future expansion of the program. At present the tax rate is included in the Manufacturer's Price Coefficient (in Section B).

(005) Interest Rate - The prevailing interest rate charged industrial or commercial clients within the region. Available from fiscal summaries or by contacting lending institutions.

(006-019) Fuel Costs - Principal sources of this information are: fuel distributers in the area; large fuel users, especially power plants; and statistical publications from the coal, oil, and utility industries. "Fuels for Fifty Cities," prepared by Ernst and Ernst, provides a good deal of information concerning fuel availability and cost in various sections of the nation. Fuel costs for electrical power generation are specifically defined since, through large volume usage and economical purchasing practices, these facilities enjoy lower fuel costs than other industrial users.

(020-026) Fuel Heat Contents - These values represent averages of the regionally available fuel types. The same sources of information listed above should be able to supply this data.

(027-033) Fuel Sulfur Contents - Three different coal and/or oil sulfur contents are chosen from among those of the available fuels in the region. These contents (generally about 2%, 1%, and 0.5%) should provide varying degrees of reduction in sulfur emissions. Other fuel characteristics (heat content and cost) are usually determined on the basis of a desired sulfur content.

(034-036) Coal Ash Content - These quantities are strongly dependent on the region from which the fuel is obtained and must thus be determined for the region under consideration.

8.1.2 Fixed-Format Dictionary Inputs

The dictionary data inputs to the Information System are punched in a fixed format as shown below and in Figure 8-5 for the Source File, Device File, and Region File. A complete dictionary input is required for each file.

Columns	Description	Format
1-3	Data element number	Numeric
4-30	Data descriptive name	Alphanumeric
31-50	Units of measure	Alphanumeric
51	Data type: N=numeric in floating point or exponential format, C=code, A=alphanumeric literal data.	Alphabetic

52-69	Lower and upper limits of N type data in exponential format, i.e., ± nnn E ± nn. Eighteen possible single code characters for C code.	Numeric or Alphanumeric

8.1.3 Job Control Language Inputs

The Job Control Language [IBM, 1969] inputs are used to control the operation of each of the models within the Implementation Planning Program. The user is advised to seek the assistance of systems programmers assigned to the given installation in preparing these inputs. No attempt will be made here to describe each element of these input cards. Figure 8-6 illustrates the Job Control Language inputs used to operate the Information System in each of four operation modes: 1) loading the dictionaries, 2) loading or updating the data files, 3) listing the data files, and 4) generation of summary output reports from the Source File.

8.2 ATMOSPHERIC DIFFUSION MODEL - PUNCHED CARD INPUTS

The following punched cards are prepared for the execution of the Atmospheric Diffusion Model. Preceding these punched card inputs are the Job Control Language inputs shown in Figure 8-7.

Code	Description
MN	&INDATA - A namelist variable indicating the start of a list of namelist inputs. No equals sign or values are associated with this variable.
MNA	REGIØN - Up to 72 characters (preceded by an apostrophe and followed by an apostrophe and comma) identifying the region being run.
ONA	DATE - Date of run (e.g., 03/05/70).
ONI	ITIME1 - Code of first season to be executed.
ONI	ITIME2 - Code of last season to be executed.
ONI	ISKIPT - Season code increment.

NOTE: Codes are summer = 1, winter = 2, and annual season = 3. If omitted, these season codes are assumed to be ITIME1=3, ITIME2=3, and ISKIPT = 1, resulting in a run for the annual season only.

ONI	IPØLU1 - Code of first pollutant to be executed.
ONI	IPØLU2 - Code of last pollutant to be executed.
ONI	ISKIPP - Pollutant code increment. Codes are: SO_2=1, CO=2, and particulate matter = 3. If omitted, the pollutant codes are assumed to be: IPØLU1=1, IPØLU2=3, and ISKIPP=2.
MNI	IAREA - Flag to indicate whether area sources are located using southwest corner or the centroid. Set to 1 for southwest corner; 2 for centroid (the loadsheets use the southwest corner).
MNP	DPTHMX - Mixing depths for the summer, winter and annual seasons (meters). All three fields must be completed, e.g., if running annual season only, the first two fields must contain a zero and a decimal point.
MNP	WNDFRQ - Wind frequencies for each wind speed class, wind direction, and wind stability class for each season (480 values for each season). Wind frequency data must be provided for all three seasons. For example, if the model is run for the annual season only, then the data for the summer and winter seasons must contain zero values. The 960 zero values can be input readily by means of the 960*0.0, repetitive value form. If only the winter season is run, then the 480 values of wind frequency data for the winter season are preceded by 480*0.0, for the summer season, and followed by 480*0.0, representing the annual seasons. The order of the wind frequency data for each season is as follows: Stability 1, Direction 1, Speed 1 . . . . Stability 1, Direction 1, Speed 6

Stability 1, Direction 2, Speed 1
. . .
. . .
. . .
Stability 1, Direction 16, Speed 6
Stability 2, Direction 1, Speed 1
. . .
. . .
. . .
Stability 5, Direction 16, Speed 6

MNP	TA - Average ambient temperature (degrees Kelvin) for each season (summer, winter, annual).
MNP	PA - Average ambient pressure (millibars) for each season (summer, winter, annual).
ONP	BLIFE - Half-life factors (hours). The data must be provided in the following order: for each pollutant for each of three seasons: SO_2 (Summer, winter, annual) CO (Summer, winter, annual)* Part. (Summer, winter, annual) If this option is omitted the program will assume an infinite half-life for each pollutant for each season.
ONP	BACKGR - Background concentrations (arithmetic mean, micrograms per cubic meter) for each pollutant and each season in the order: SO_2 - summer, SO_2 - winter, SO_2 - annual, CO - summer, CO - winter, ... Particulate matter-annual.
ONI	INCRX - Number of columns in the receptor grid. If omitted, this variable is assumed to be 15.
ONI	INCRY - Number of rows in the receptor grid. If omitted, this variable is assumed to be 15.

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[*] The CO half-life parameter has been included for future expansion of the program.

ONP	DELTA - Distance (kilometers) between two adjacent rows or columns. If omitted, this variable is assumed to be 15.
MNP	RBASE - X and Y coordinates (kilometers) of southwest corner of receptor grid system.
ONI	IADD - Number of non-grid receptors. This value must be less than or equal to 50.
ONI	XRECEP - X, Y (kilometers) locations for the IADD non-grid receptors.
ONI	IPUNCH - Flag to indicate whether receptor ground level concentration output is to be punched on cards for use in plotting concentration isopleths. Set to one (1) for punched card output; a zero (0) indicates no punched card output. If omitted, flag will automatically be set to one (1).
MNI	IREG - Flag to indicate which regression option is to be used. A zero indicates that input regression constants are to be applied to the Atmospheric Diffusion Model output; a one (1) indicates calibration of the model followed by the Model run; a two (2) indicates calibration only. If calibration values are to be calculated, the following variables must be input: number of stations (NS02 and/or NPART), and station location and measured concentration data (S020B and/or PAR0B). If the calibration constants are input, they are defined by S02CAL and/or PARCAL.
ONP	S02CAL - Regression line constants (y-intercept and slope) for sulfur dioxide repeated for each of three seasons.
ONP	PARCAL - Regression line constants (y-intercept, slope) for suspended particulate matter repeated for each of three seasons.

ONP	NS02 - Number of SO_2 measuring stations. If omitted, this variable is assumed to be zero.
ONP	NPART - Number of particulate measuring stations. If omitted, this variable is assumed to be zero.
ONP	S020B - Up to one hundred (100) sets of SO_2 measuring station locations and observed values are input in the following order for each station: x-coordinate and y-coordinate of station; measured concentration values for summer, winter and annual. If omitted, this variable is assumed to be zero for all values.
ONP	PAR0B - Up to one hundred (100) sets of particulate matter measuring stations and observed values are input in the following order for each station: x-coordinate and y-coordinate of station; measured concentration values for summer, winter, and annual. If omitted, this variable is assumed to be zero for all values.
ONI	ISTAT - Flag to indicate if table data for the annual period is desired: zero (0) for output, one (1) for no output. This data includes the Excess Concentration table, Source Contribution table and the Statistical table.
ONP	AQSTAN - Air quality standards (arithmetic mean in micrograms per cubic meter) must be input in the following order: SO_2, CO, and particulate matter. If omitted, this variable assumed to be zero for all values.
ONI	NSEL5 - Flag to indicate if the five (5) receptors on the Source Contribution table are input (NSEL5=1) or are the five receptors of maximum concentration and therefore selected by the program (NSEL5=0). If omitted, NSEL5=0.

ONI	ICØNS* - Five (5) SO_2 receptor location numbers for source contribution table output. If NSEL5=1, all 5 values must be input.
ONP	ICØNP* - Five (5) particulate matter receptor location numbers for source contribution table output. If NSEL5=1, all 5 values must be input.
ONI	NSEL12 - Flag to indicate whether statistical output is desired: zero (0) for no, one (1) for yes. If statistical output is requested, the following variables must also be present: Up to twelve (12) receptor numbers per pollutant for statistical output (ISTATS and/or ISTATP); Standard geometric deviations corresponding to each receptor number specified (SGDS and/or SGDP); five (5) averaging times for each pollutant (SØ2AVG and/or PARAVG); and three (3) percentile values (PERCNT).
ONI	ISTATS* - Twelve (12) SO_2 receptor location numbers for statistical output. If less than 12 values are used, the remaining values must be input as zeros.
ONI	ISTATP* - Twelve (12) particulate matter receptor location numbers for statistical output. If less than 12 values are used, the remaining values must be input as zeros.
ONP	SØ2AVG - Five averaging times for SO_2 expressed in hours. If less than five values are used, the remaining values must be replaced by zeros.

---

*Receptor location numbers are selected from the basic set of input receptors. The numbering system of the basic set is defined as follows: first number the grid receptor locations consecutively, increasing from bottom to top within each column and by column from left to right; then number the non-grid receptors, continuing from the last grid receptor number, in the order they are input. The basic set will then contain INCRX*INCRY + IADD receptor numbers.

ONP	PARAVG - Five averaging times for particulate matter expressed in hours. If less than five values are used, the remaining values must be replaced by zeros.
ONI	SGDS - Standard geometric deviation (24-hour period) for SO_2 corresponding to the ISTATS receptor numbers. These values must be input in the same order as the receptor location numbers to which they refer.
ONP	SGDP - Standard geometric deviations, (24-hour period) for particulate matter corresponding to the ISTATP receptor numbers. The values must be input in the same order as the receptor location numbers to which they refer.
ONP	PERCNT - Three percentile values must be input for statistical computation (percentage).
MN	&END - This variable signifies the end of a list of inputs. No values are associated with this variable.

The Installation Test Case input preparation for the Atmospheric Diffusion Model is shown in Figure 8-8.

8.3 CONTROL COST MODEL - PUNCHED CARD INPUTS

The following punched cards are prepared for the execution of the Control Cost Model. Preceding these punched card inputs are the Job Control Language inputs shown in Figure 8-9.

CODE	DESCRIPTION
MF	Date Card - The date of the run is input using columns 49-80 (e.g., 03/06/70)
MF	Source/Device Applicability Data Card 1 -

Columns	Description	Format
1-4	SIC number (see Section 8.1.1 item Alc)	4 integers; no decimal

5-7	Blank	--
8	Process number (See Section 8.1.1 item A1c)	1 integer; no decimal
9-11	Source correction factor for device 1 (See Table 5-2)	Sign plus 2 integers; decimal assumed after column 11. If correction factor is 1 digit use column 11.
12-14	Source correction factor for device 2	Sign plus 2 integers; decimal assumed after column 14.
• • •	• • •	• • •
78-80	Source correction factor for device 24	Sign plus 2 integers; decimal assumed after column 80.

MF Source/Device Applicability Data Card 2 -

Columns	Description	Format
1-2	Blank	--
3-5	Source correction factor for device 25	Sign plus 2 integers; decimal assumed after column 5.
• • •	• • •	• • •
78-80	Source correction factor for device 50	Sign plus 2 integers; decimal assumed after column 80.

NOTE: The above two cards are repeated as many times as necessary. Non-applicable devices are indicated by a 99 in place of the source correction factor. If the process number in card 1 is zero, indicating a combustion source, the SIC number is ignored, i.e., the same group of control devices is applied to all combustion sources.

The Installation Test Case input preparation for the Control Cost Model is shown in Figure 8-10.

8.4 CONTROL STRATEGY MODEL - PUNCHED CARD INPUTS

8.4.1 Control Standards Segment (C0NREG)

The following punched cards are prepared for the first step in the execution of the Control Strategy Model. Preceding these punched card inputs are the Job Control Language inputs shown in Figure 8-11.

CODE	DESCRIPTION
MF	Date Card - The date is to be entered in the first 8 columns of the card in the following manner - month/day/year. Example: 02/01/70.
MN	&REGIN - Indicates the beginning of the namelist input for the first step of the Control Strategy Model. No equals sign or values are required for this variable.
MNI	IREG0N - Three-digit code number for the region to be controlled (See Appendix D for list of regions).
ONI	ILIST - Set to one (1) if the emission standards output is to be listed on the printer. If omitted, no intermediate printed C0NREG output (Figure 6-9) will be produced.
ONI	IDUMP - Set to one (1) if an unformatted computer memory listing of the input cost data is desired (Figure 6-10). If omitted, no printed output of the cost data will be produced.
ONP	TAB01 - Table number 1 provides the breakpoints in a piecewise linear representation of particulate matter fuel combustion emission standard number 1. The emission standard is assumed to consist of straight line segments on log-log paper; each breakpoint, starting at the abscissa, is defined first by the abscissa value (heat capacity, BTU/10^6) and then the ordinate value (allowable emission, lbs/10^6BTU). Four pairs (8) of values must be input. If omitted, this table will assume the values of the curve in Figure 6-1.

ONP	TAB02 - Table number 2 describes particulate fuel combustion emission standard number 2. Forty-two (42) values must be specified to define the 3 breakpoints for 7 stack heights. The input order requires three abscissa-ordinate pairs for the lowest stack height curve followed by three abscissa-ordinate pairs for the next stack height curve, and so forth. If omitted, curve in Figure 6-2 will be used.
ONP	TAB03 - Table number 3 describes particulate fuel combustion emission standard number 3. Forty-two (42) values must be specified to define the 3 breakpoints for 7 stack heights (same input order as TAB02). If omitted, curve in Figure 6-3 will be used.
ONP	TAB04 - Table number 4 describes particulate fuel combustion emission standard number 4. Eight (8) values must be specified. If omitted, curve in Figure 6-4 will be used.
ONP	TAB05 - Table number 5 describes particulate fuel combustion emission standard number 5. Ten (10) values must be specified. If omitted, curve in Figure 6-5 will be used.
ONP	TAB06 - Table number 6 describes particulate industrial process emission standard number 1. Six (6) values must be specified. If omitted, curve in Figure 6-6 will be used.
ONP	TAB07 - Table number 7 describes curve to be used for foundries with process rate (under PLIP02 lbs/hr) in particulate industrial process emission standard number 2. Eight (8) values must be specified. If omitted, curve in Figure 6-7 will be used.
ONP	TAB08 - Table number 8 describes curve to be used for foundries (with process rate over PLIP02 lbs/hr) in particulate industrial process emission standard number 2. Six (6) values

	must be specified. If omitted, curve in Figure 6-6 will be used.
ONP	TAB09 - Table number 9 describes curve to be used for all applicable sources other than foundries in particulate industrial process emission standard number 2. Six (6) values must be specified. If omitted, curve in Figure 6-6 will be used.
ONP	TAB10 - Table number 10 describes curve to be used for particulate industrial process emission standard number 3. Six (6) values must be specified. If omitted, curve in Figure 6-6 will be used.
ONP	TAB11 - Table number 11 describes curve to be used for particulate industrial process emission standard number 4. Ten (10) values must be specified. If omitted, curve in Figure 6-5 will be used.
ONP	TAB12 - Table number 12 describes curve to be used for particulate industrial process emission standard number 6. Twenty-two (22) values must be specified. If omitted, curve in Figure 6-8 will be used.
ONP	TAB13 - Table number 13 describes curve to be used for particulate solid waste disposal emission standard number 4. Ten (10) values must be specified. If omitted, curve in Figure 6-5 will be used.
ONP	PEFC03 - Minimum collection efficiency (decimal value) for particulate fuel combustion emission standard number 3 (Figure 6-3). If omitted, a value of 0.85 will be used.
ONP	PEI01 - Minimum collection efficiency (decimal value) for particulate industrial process emission standard number 1 (Figure 6-1). If omitted, a value of 0.85 will be used.

ONP	PMIP01 - Maximum emission limits (g/scf) for determining the allowable emission in particulate industrial process emission standard number 1 (Figure 6-1). Two values must be specified; the first applies to foundries, the second to all other applicable sources. If omitted, values of 0.4 and 0.3 g/scf will be used.
ONP	PEIP01 - Minimum collection efficiency (decimal value) for particulate industrial process emission standard number 1 (Figure 6-1). Two values must be specified; the first applies to catalytic crackers, the second to cement manufacturing. If omitted, 0.997 will be used for both.
ONP	PLIP02 - Size limitation (lbs/hr) to determine which portion of the foundry exception to particulate industrial process emission standard number 2 (Figure 6-2) should be used. If omitted, a value of 200,000 will be used.
ONP	PMIP02 - Maximum emission limits (g/scf) for determining the allowable emission in particulate industrial process emission standard number 2 (Figure 6-2). Two values must be specified; the first applies to blast furnaces, the second to cement manufacturing. If omitted, a value of 0.1 will be used for both.
ONP	PLSW01 - Size limitation (lbs/hr) to determine which portion of the particulate solid waste disposal emission standard number 1 (Figure 6-1) applies. If omitted, a value of 200 lbs/hr will be used.
ONP	PMSW01 - Maximum emission limits (g/scf) for determining allowable emissions in particulate solid waste disposal emission standard number 1 (Figure 6-1). Two values must be specified; the first applies to incinerators with capacity equal to or less than PLSW01 lbs/hr; the second applies to incinerators greater than

	PLSW01 lbs/hr. If omitted, values of 0.2 and 0.3 g/scf will be used.
ONP	PLSW02 - Size limitation (lbs/hr) to determine which portion of the particulate solid waste disposal emission standard number 2 (Figure 6-2) applies. If omitted, a value of 1000 lbs/hr is used.
ONP	PMSW02 - Maximum emission limits (g/scf) for determining allowable emissions in particulate solid waste disposal emission standard number 2 (Figure 6-2). Two values must be specified; the first applies to incinerators with capacity equal to or less than PLSW02 lbs/hr; the second applies to incinerators greater than PLSW02 lbs/hr. If omitted, values of 0.2 and 0.35 g/scf will be used.
ONP	PLSW03 - Size limitation (lbs/hr) to determine which portion of the particulate solid waste disposal emission standard number 2 (Figure 6-2) applies. If omitted, a value of 200 lbs/hr will be used.
ONP	PMSW03 - Maximum emission limits (g/scf) for determining allowable emissions in particulate solid waste disposal emission standard number 3 (Figure 6-3). Two values must be specified; the first applies to incinerators with capacity equal to or less than PLSW03 lbs/hr; the second applies to incinerators with a capacity greater than PLSW03 lbs/hr. If omitted, values of 0.2 and 0.3 will be used.
ONP	SLF01 - Size limitation (10^6 BTU/hr) to determine which portion of the SO_2 fuel combustion emission standard number 1 (Figure 6-1) applies. If omitted, a value of $2000 \cdot 10^6$ BTU/hr will be used.
ONP	SMFC01 - Maximum emission limit (lbs/10^6 BTU input) for SO_2 fuel combustion emission standard number 1 (Figure 6-1). If omitted, a value of 2.3 lbs/10^6 BTU will be used.

ONP	SEFC02 - Minimum collection efficiency (decimal value) for SO_2 fuel combustion emission standard number 2 (Figure 6-2). If omitted, a value of 0.85 will be used.
ONP	SMIP01 - Maximum emission limit (ppm) for SO_2 industrial process emission standard number 1 (Figure 6-1). If omitted, a value of 2000 ppm will be used.
ONP	SMIP02 - Maximum emission limit (ppm) SO_2 industrial process emission standard number 2 (Figure 6-2). If omitted, a value of 500 ppm will be used.
MN	&END - This variable signifies the end of a list of namelist inputs.

The Installation Test Case input preparation for the Control Standards Segment of the Control Strategy Model is shown in Figure 8-12.

8.4.2 Strategy Output Segment (CSTAB)

The following cards are prepared for the second step in the execution of the Control Strategy Model. Preceding these punched cards are the Job Control Language inputs shown in Figure 8-13.

Code	Description
MN	&CØNIN - Indicates start of CSTAB namelist imput. No equals sign or values are required for this variable.
MNA	IDATE - Date of run; 8 alpha-numeric characters (i.e., 02/05/70).
MNI	IJUR - Total number of political jurisdictions in the region.
MNI	NREGØN - Three-digit code number for the region to be controlled (see Appendix D for list of regions).
ONP	AQSTAN - Air Quality standard for each pollutant (SO_2, particulate matter) in micrograms per cubic meter. If omitted, a value of 0.0 is used for each pollutant.
ONP	ASFAC - Area source scale factor (see Chapter 6). Two values must be input; the first is for SO_2, the second for particulate matter. If omitted, a value of 1.0 is used for both.
ONI	IPLØT - Set to one (1) if punched card ground level concentration data is desired for plotting. If omitted, punched card output will not be produced.
ONI	ISTATP - Twelve (12) receptor numbers must be identified to provide output in the statistical table (geometric mean, maximum concentration, etc.) for SO_2. If less than 12 receptors are specified, the remaining values must be input as zeros. If omitted, statistical data on SO_2 will not be provided.
ONI	ISTATS - Twelve (12) receptor numbers must be identified to provide output in the statistical table for particulate

	matter. If less than 12 receptors are specified, the remaining values must be input as zeros. If omitted, statistical output for particulate matter will not be provided.
ONI	IPR0J - Projection flag for projecting ground level concentrations to some future date. Set to one (1) if emission rate scale factors, on which the projection is based, are input (see Projection Data Card). If omitted, no projections will be provided.
ONI	NSEL12 - Set to one (1) if statistical output is desired. If omitted, no statistical output will be provided.
ONP	PARAVG - Three (3) averaging times (hours) must be input for the particulate matter statistical output option. At least one value must be non-zero if particulate matter statistical output has been requested.
ONP	PARPER - Three (3) percentile levels must be input for the particulate matter statistical output option. At least one value must be non-zero if particulate matter statistical output has been requested.
ONP	PFAC1 - Two (2) Y-intercept calibration values must be input for this option (first value is for SO_2, the second for particulate matter). If omitted, a value of zero is assumed for each pollutant.
ONP	PFAC2 - Two (2) slope calibration values must be input for this option (first value is for SO_2, the second for particulate matter). If omitted, a value of 1.0 is assumed for each pollutant.
ONA	REGI0N - Up to 72 characters can be input to describe the name of the region. If omitted, title line in the output will be left blank.
ONP	SGDP - Twelve (12) standard geometric deviations must be input for the particulate matter statistical output

	option. One value must be input for each ISTATP receptor number, and the order in which they are input must correspond to the order of receptor number inputs.
ONP	SGDS - Twelve (12) standard geometric deviations must be input for the SO_2 statistical output option. One value must be input for each ISTATS receptor number, and the order in which they are input must correspond to the order of receptor number inputs.
ONP	S02AVG - Three (3) averaging times (hours) must be input for the SO_2 statistical output option. At least one value must be non-zero if SO_2 statistical output has been requested.
ONP	S02PER - Three (3) percentile levels must be input for the SO_2 statistical output option. At least one value must be non-zero if SO_2 statistical output has been requested.
ONP	UTM - The X and Y-coordinates of the UTM origin must be input for converting receptor locations to the UTM system. If omitted, values of zero will be used for X and Y.
MN	&END - This variable signifies the end of a list of namelist inputs.
MF	Political Jurisdiction Name Card - One card is input for each political jurisdiction (in any order) with the jurisdiction name (alphabetic) in columns 1-20.
MF	Strategy Cards - One card is input for each political jurisdiction (in the same order as previous input). Each card contains:

Columns	Description	Format (right justified)
1-3	Pollutant number	nnn - (1 = SO_2, 2 = particulate matter
4-6	Political jurisdiction number	nnn - (arbitrary)

7-9	Fuel combustion standard number	nnn	These numbers refer to emission standards in Figure 6-1 through 6-6 or arbitrary numbers for hand-calculated emission standards.
10-12	Industrial process standard number	nnn	
13-15	Solid waste disposal standard number	nnn	

OF Projection Data Card:

Columns	Description	Format (right justified)
1-4	SIC number	nnnn (see Section 8.1.1 item Alc)
5-7	Site number	nnn (see Section 8.1.1 item Alb)
5-8	Process number	nnn (see Section 8.1.1 item alc) (Zero for area source)
9-13	SO_2 scale factor	n.nn
14-18	Particulate matter scale factor	n.nn

NOTE: One projection data card is required for each point and area source. This projection data is loaded on disk using an IBM utility routine (Figure 8-13).

The Installation Test Case input preparation for the Strategy Output Segment of the Control Strategies Model is shown in Figure 8-14.

8.5 STRATEGY INPUT FILE UPDATE PROGRAM - PUNCHED CARD INPUTS

The following cards are prepared for the execution of a program to update the output of both the Control Cost Model and Source File inputs to the Control Strategy Model. This program corresponds to the Test Setup shown in Figure 10-4. Preceding these punched card inputs are the Job Control Language inputs shown in Figure 8-15.

Code	Description
MN	&STRATM - Indicates the beginning of the namelist input for the Strategy Input File Update Program. No equals sign or values required for this variable.
MNI	LS0R - Eight digits which identify the source affected by the update change. The first four digits are the SIC code

	the next three are the site number, and the last digit is the process type (see Section 8.1.1).
MNI	IDDEV - Three digits which identify the control device (using the IPP device code, Table 5-1) affected by the update run.

NOTE: These three variables are required for every source/device record which is to be changed. Record updates must be in ascending order by source identification number (LS0R), and for each source, in order by device number (IDDEV). In addition, there must be only one set of these three variables for each source/device pair.

Any data item or combination of data items in the Strategy Input File record for the specified source/device pair may be modified, and within an update record, no special order of input is required. Items to be changed are identified using the names listed below. In every case, omission of one of the items listed below will result in that item remaining unchanged.

ONI	IREGR - Three digits specifying the region number.
ONA	PRTYPE - A single alphabetic character specifying the source type.
ONA	PRUNMF - A single alphabetic character specifying the manufacturing process units.
ONI	P0LJUR - Two digits specifying the political jurisdiction.
ONP	DEVEFS - Selected control device SO_2 control efficiency (decimal value). For example, 98% efficiency would be designated .98.
ONP	DEVEFP - Selected control device particulate control efficiency (decimal value).
ONP	EMRATS - Existing SO_2 emission rate (tons/day).
ONP	EMRATP - Existing particulate emission rate (tons/day).
ONP	PRCRTM - Process rate (process units/day).

ONP	SHIFTS - Shifts per day.
ONP	STKHTN - Stack height (meters).
ONP	EXVELN - Exit velocity (meters/second).
ONP	TEXN - Exit temperature (degrees Kelvin).
ONP	RATCAP - Rated capacity (BTU/hr.).
ONP	ØFSCØ - Original fuel sulfur content (decimal). If multiple fuels are in use, this value represents the highest sulfur content of those fuels in use.
ONP	AFS - Alternate (control measure) fuel sulfur content (decimal).
ONP	CØNEF - Existing control device particulate efficiency (decimal).
ONP	ACFMN - Output gas volume (ft^3/min).
ONP	TAC - Total annual cost ($).
ONP	DESER - Design emission rate (tons/day).
ONP	DESPER - Design potential emission rate (tons/day).
MN	&END - This variable signifies the end of a list of namelist inputs.

The Installation Test Case input preparation for the Strategy Input File Update is shown in Figure 8-16.

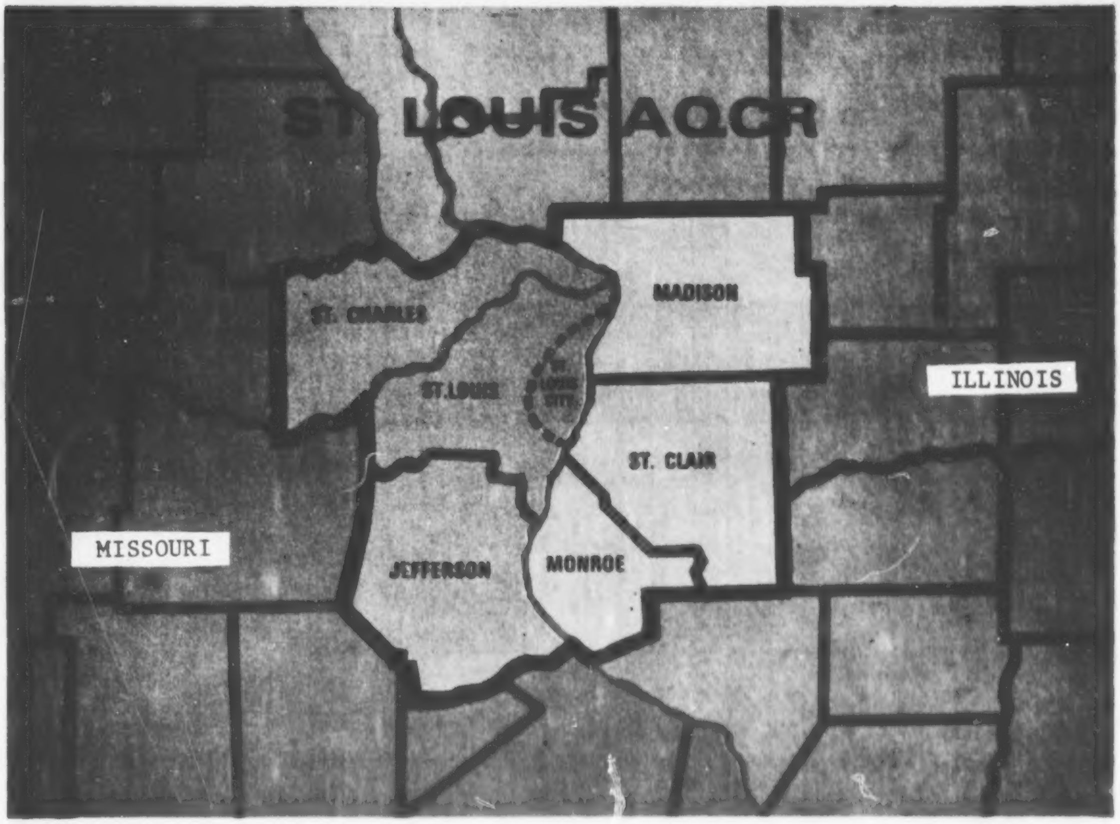
8.6 CONTROL STRATEGIES MODEL UPDATE - PUNCHED CARD INPUT

The following cards are prepared for the execution of a program to update the Control Standards (CØNREG) segment output of the Control Strategies Model (see Test Setup, Figure 10-6). Preceding these punched card inputs are the Job Control Language inputs shown in Figure 8-17.

Code	Description		
MF	Card 1		
	Columns	**Description**	**Format**
	1	Procedure code	A - add a record D - delete the record specified. C - change the record specified.
	2-4	Region number	nnn
	5-12	Source identification	nnnnnnnn (SIC, Site, and Process codes)
	13-15	Device identification	nnn (Table 5-1)
	16-17	Blank	---
	18	Pollutant number	1 - SO_2 2 - Particulate matter
	19-20	Political jurisdiction	nn
	21	Emission standard class	1 - Fuel combustion 2 - Industrial process 3 - Solid waste disposal
	22-23	Emission standard number	nn (Table 6-1)
	24-25	Blank	---
	26-38	Device cost ($)	Floating point (see Section 8.1)
	39-51	SO_2 device efficiency (decimal)	Floating point
	52-64	Particulate device efficiency (decimal)	Floating point
	65-77	Allowable emission (tons/day)	Floating point
	78-80	Blank	---
MF	Card 2		
	1-13	Existing emission (tons/day)	Floating point

	14-26	Stack height (meters)	Floating point
	27-39	Stack temperature (degrees K)	Floating point
	40-52	Stack diameter (meters)	Floating point
	53-65	Stack gas velocity (meters/sec)	Floating point
	66-67	Additional device	0.0
	68-80	Additional device	0.0
MF	Card 3		
	1-13	Additional device	0.0
	14-26	Additional device	0.0
	27-39	Additional device	0.0
	40-52	Additional device	0.0
	53-80	Blank	---

NOTE: If the procedure code is "D," card 1 is the only card needed. For code "C" entire record must be input, even though only one or two items are being changed, i.e., the unchanged items must be included also. The last two fields on card 2 and all of card 3 must be input to provide proper initialization of fields which have been included for future expansion of the program.


ST LOUIS AQCR
ST. CHARLES
MADISON
ST. LOUIS
ST. LOUIS CITY
ILLINOIS
ST. CLAIR
MISSOURI
JEFFERSON
MONROE

INDUSTRIAL PLANTS

- Chemical
- Sulfuric Acid (4)
- Nitric Acid
- Fertilizer
- Oil Refinery
- Asphalt Batching
- Cement
- Rock, Sand, & Gravel
- Steel Mill (blast furnace)
- Steel Mill (BOF)
- Steel Mill (sintering)
- Foundry (2)
- Lead Smelting & Sintering (2)
- Railroad Car

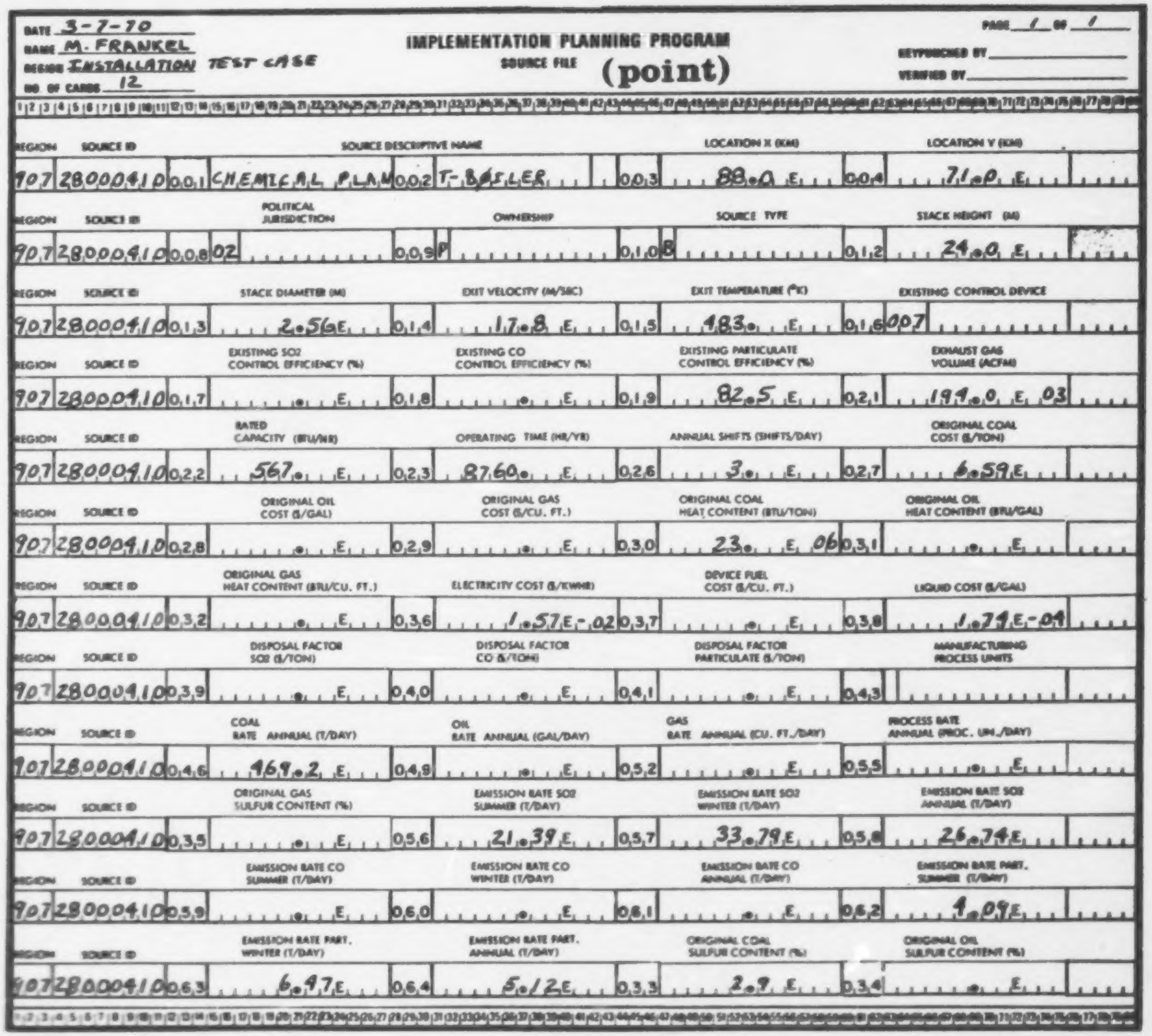
UTILITIES

- Power Plant (3)

WASTE DISPOSAL

- Incinerator

Figure 8-1 Stationary Sources of Air Pollution in the Installation Test Case



DATE 3-7-70
NAME M. FRANKEL
REGION INSTALLATION TEST CASE
NO. OF CARDS 12

IMPLEMENTATION PLANNING PROGRAM
SOURCE FILE (point)

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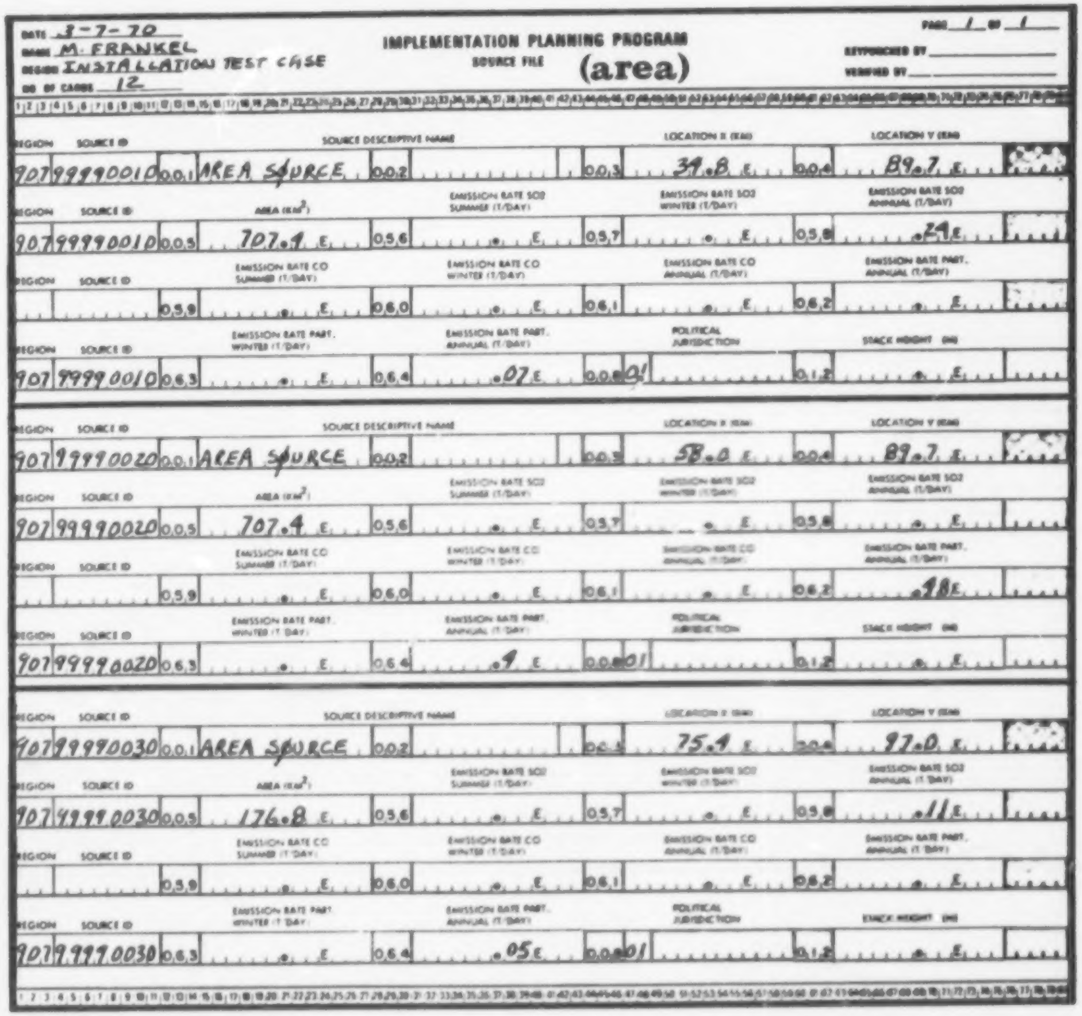
REGION	SOURCE ID		SOURCE DESCRIPTIVE NAME				LOCATION X (KM)		LOCATION Y (KM)
907	28000410	001	CHEMICAL PLAN	002	T-BØILER	003	88.0 E	004	71.0 E
REGION	SOURCE ID		POLITICAL JURISDICTION		OWNERSHIP		SOURCE TYPE		STACK HEIGHT (M)
907	28000410	008	02	009	P	010	B	012	24.0 E
REGION	SOURCE ID		STACK DIAMETER (M)		EXIT VELOCITY (M/SEC)		EXIT TEMPERATURE (°K)		EXISTING CONTROL DEVICE
907	28000410	013	2.56 E	014	17.8 E	015	483. E	016	007
REGION	SOURCE ID		EXISTING SO2 CONTROL EFFICIENCY (%)		EXISTING CO CONTROL EFFICIENCY (%)		EXISTING PARTICULATE CONTROL EFFICIENCY (%)		EXHAUST GAS VOLUME (ACFM)
907	28000410	017	. E	018	. E	019	82.5 E	021	194.0 E 03
REGION	SOURCE ID		RATED CAPACITY (BTU/HR)		OPERATING TIME (HR/YR)		ANNUAL SHIFTS (SHIFTS/DAY)		ORIGINAL COAL COST ($/TON)
907	28000410	022	567. E	023	8760. E	026	3. E	027	6.59 E
REGION	SOURCE ID		ORIGINAL OIL COST ($/GAL)		ORIGINAL GAS COST ($/CU. FT.)		ORIGINAL COAL HEAT CONTENT (BTU/TON)		ORIGINAL OIL HEAT CONTENT (BTU/GAL)
907	28000410	028	. E	029	. E	030	23. E 06	031	. E
REGION	SOURCE ID		ORIGINAL GAS HEAT CONTENT (BTU/CU. FT.)		ELECTRICITY COST ($/KWHR)		DEVICE FUEL COST ($/CU. FT.)		LIQUID COST ($/GAL)
907	28000410	032	. E	036	1.57 E-02	037	. E	038	1.74 E-04
REGION	SOURCE ID		DISPOSAL FACTOR SO2 ($/TON)		DISPOSAL FACTOR CO ($/TON)		DISPOSAL FACTOR PARTICULATE ($/TON)		MANUFACTURING PROCESS UNITS
907	28000410	039	. E	040	. E	041	. E	043	
REGION	SOURCE ID		COAL RATE ANNUAL (T/DAY)		OIL RATE ANNUAL (GAL/DAY)		GAS RATE ANNUAL (CU. FT./DAY)		PROCESS RATE ANNUAL (PROC. UN./DAY)
907	28000410	046	469.2 E	049	. E	052	. E	055	. E
REGION	SOURCE ID		ORIGINAL GAS SULFUR CONTENT (%)		EMISSION RATE SO2 SUMMER (T/DAY)		EMISSION RATE SO2 WINTER (T/DAY)		EMISSION RATE SO2 ANNUAL (T/DAY)
907	28000410	035	. E	056	21.39 E	057	33.79 E	058	26.74 E
REGION	SOURCE ID		EMISSION RATE CO SUMMER (T/DAY)		EMISSION RATE CO WINTER (T/DAY)		EMISSION RATE CO ANNUAL (T/DAY)		EMISSION RATE PART. SUMMER (T/DAY)
907	28000410	059	. E	060	. E	061	. E	062	4.09 E
REGION	SOURCE ID		EMISSION RATE PART. WINTER (T/DAY)		EMISSION RATE PART. ANNUAL (T/DAY)		ORIGINAL COAL SULFUR CONTENT (%)		ORIGINAL OIL SULFUR CONTENT (%)
907	28000410	063	6.47 E	064	5.12 E	033	2.9 E	034	. E

Figure 8-2. Source File Loadsheets



DATE 3-7-70
NAME M. FRANKEL
REGION INSTALLATION TEST CASE
NO OF CARDS 12

IMPLEMENTATION PLANNING PROGRAM
SOURCE FILE (area)

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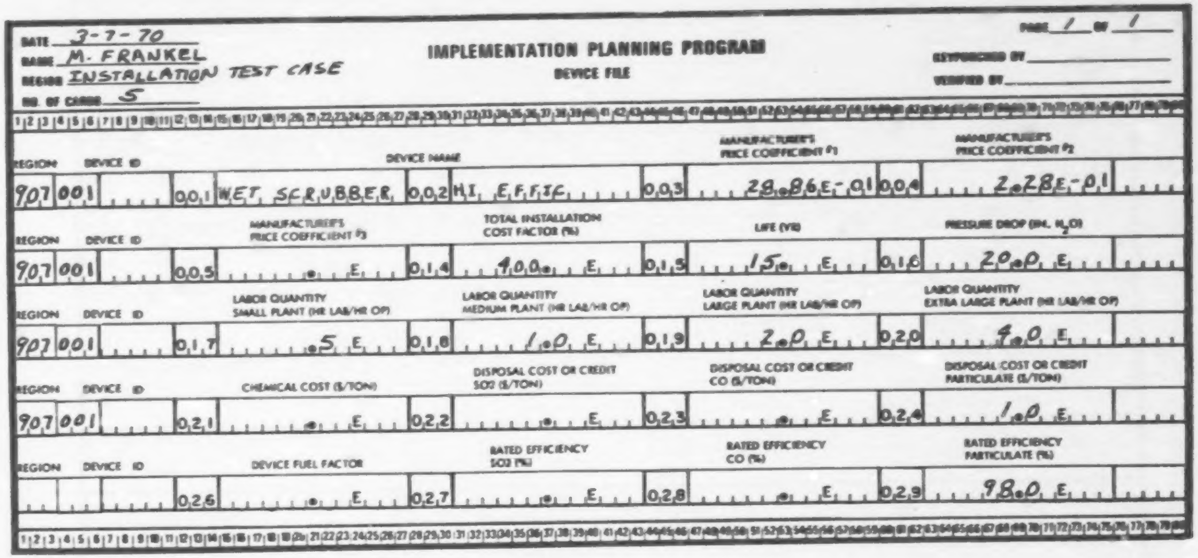
REGION	SOURCE ID		SOURCE DESCRIPTIVE NAME				LOCATION X (KM)		LOCATION Y (KM)
907	99990010	001	AREA SOURCE	002		003	34.8 E	004	89.7 E
REGION	SOURCE ID		AREA (KM²)		EMISSION RATE SO2 SUMMER (T/DAY)		EMISSION RATE SO2 WINTER (T/DAY)		EMISSION RATE SO2 ANNUAL (T/DAY)
907	99990010	005	707.4 E	056	. E	057	. E	058	.24 E
REGION	SOURCE ID		EMISSION RATE CO SUMMER (T/DAY)		EMISSION RATE CO WINTER (T/DAY)		EMISSION RATE CO ANNUAL (T/DAY)		EMISSION RATE PART. ANNUAL (T/DAY)
		059	. E	060	. E	061	. E	062	. E
REGION	SOURCE ID		EMISSION RATE PART. WINTER (T/DAY)		EMISSION RATE PART. ANNUAL (T/DAY)		POLITICAL JURISDICTION		STACK HEIGHT (M)
907	99990010	063	. E	064	.07 E	008 01		012	. E

REGION	SOURCE ID		SOURCE DESCRIPTIVE NAME				LOCATION X (KM)		LOCATION Y (KM)
907	99990020	001	AREA SOURCE	002		003	58.0 E	004	89.7 E
REGION	SOURCE ID		AREA (KM²)		EMISSION RATE SO2 SUMMER (T/DAY)		EMISSION RATE SO2 WINTER (T/DAY)		EMISSION RATE SO2 ANNUAL (T/DAY)
907	99990020	005	707.4 E	056	. E	057	. E	058	. E
REGION	SOURCE ID		EMISSION RATE CO SUMMER (T/DAY)		EMISSION RATE CO WINTER (T/DAY)		EMISSION RATE CO ANNUAL (T/DAY)		EMISSION RATE PART. ANNUAL (T/DAY)
		059	. E	060	. E	061	. E	062	.98 E
REGION	SOURCE ID		EMISSION RATE PART. WINTER (T/DAY)		EMISSION RATE PART. ANNUAL (T/DAY)		POLITICAL JURISDICTION		STACK HEIGHT (M)
907	99990020	063	. E	064	.9 E	008 01		012	. E

REGION	SOURCE ID		SOURCE DESCRIPTIVE NAME				LOCATION X (KM)		LOCATION Y (KM)
907	99990030	001	AREA SOURCE	002		003	75.4 E	004	97.0 E
REGION	SOURCE ID		AREA (KM²)		EMISSION RATE SO2 SUMMER (T/DAY)		EMISSION RATE SO2 WINTER (T/DAY)		EMISSION RATE SO2 ANNUAL (T/DAY)
907	99990030	005	176.8 E	056	. E	057	. E	058	.11 E
REGION	SOURCE ID		EMISSION RATE CO SUMMER (T/DAY)		EMISSION RATE CO WINTER (T/DAY)		EMISSION RATE CO ANNUAL (T/DAY)		EMISSION RATE PART. ANNUAL (T/DAY)
		059	. E	060	. E	061	. E	062	. E
REGION	SOURCE ID		EMISSION RATE PART. WINTER (T/DAY)		EMISSION RATE PART. ANNUAL (T/DAY)		POLITICAL JURISDICTION		STACK HEIGHT (M)
907	99990030	063	. E	064	.05 E	008 01		012	. E

Figure 8-2 Source File Loadsheet (continued)



DATE 3-7-70
NAME M. FRANKEL
REGION INSTALLATION TEST CASE
NO. OF CARDS 5

IMPLEMENTATION PLANNING PROGRAM
DEVICE FILE

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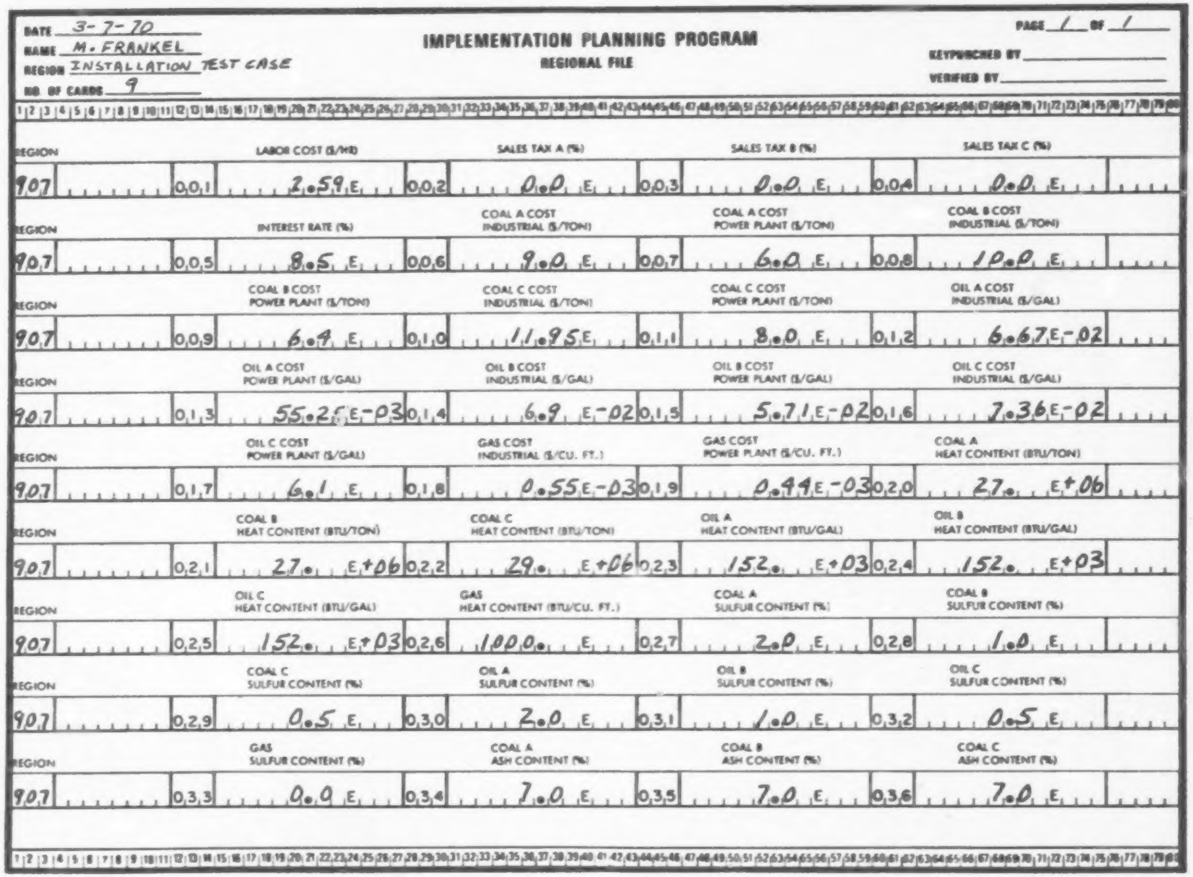
REGION	DEVICE ID			DEVICE NAME				MANUFACTURER'S PRICE COEFFICIENT #1		MANUFACTURER'S PRICE COEFFICIENT #2	
907	001		001	WET SCRUBBER	002	HI EFFIC	003	28.86E-01	004	2.28E-01	
REGION	DEVICE ID			MANUFACTURER'S PRICE COEFFICIENT #3		TOTAL INSTALLATION COST FACTOR (%)		LIFE (YR)		PRESSURE DROP (IN. H_2O)	
907	001		005	. E	014	400. E	015	15. E	016	20.0 E	
REGION	DEVICE ID			LABOR QUANTITY SMALL PLANT (HR LAB/HR OP)		LABOR QUANTITY MEDIUM PLANT (HR LAB/HR OP)		LABOR QUANTITY LARGE PLANT (HR LAB/HR OP)		LABOR QUANTITY EXTRA LARGE PLANT (HR LAB/HR OP)	
907	001		017	.5 E	018	1.0 E	019	2.0 E	020	4.0 E	
REGION	DEVICE ID			CHEMICAL COST ($/TON)		DISPOSAL COST OR CREDIT SO2 ($/TON)		DISPOSAL COST OR CREDIT CO ($/TON)		DISPOSAL COST OR CREDIT PARTICULATE ($/TON)	
907	001		021	. E	022	. E	023	. E	024	1.0 E	
REGION	DEVICE ID			DEVICE FUEL FACTOR		RATED EFFICIENCY SO2 (%)		RATED EFFICIENCY CO (%)		RATED EFFICIENCY PARTICULATE (%)	
			026	. E	027	. E	028	. E	029	98.0 E	

Figure 8-3. Device File Loadsheet



DATE 3-7-70
NAME M. FRANKEL
REGION INSTALLATION TEST CASE
NO. OF CARDS 9

IMPLEMENTATION PLANNING PROGRAM
REGIONAL FILE

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REGION			LABOR COST ($/HR)		SALES TAX A (%)		SALES TAX B (%)		SALES TAX C (%)	
907		001	2.59 E	002	0.0 E	003	0.0 E	004	0.0 E	
REGION			INTEREST RATE (%)		COAL A COST INDUSTRIAL ($/TON)		COAL A COST POWER PLANT ($/TON)		COAL B COST INDUSTRIAL ($/TON)	
907		005	8.5 E	006	9.0 E	007	6.0 E	008	10.0 E	
REGION			COAL B COST POWER PLANT ($/TON)		COAL C COST INDUSTRIAL ($/TON)		COAL C COST POWER PLANT ($/TON)		OIL A COST INDUSTRIAL ($/GAL)	
907		009	6.4 E	010	11.95 E	011	8.0 E	012	6.67 E-02	
REGION			OIL A COST POWER PLANT ($/GAL)		OIL B COST INDUSTRIAL ($/GAL)		OIL B COST POWER PLANT ($/GAL)		OIL C COST INDUSTRIAL ($/GAL)	
907		013	55.25 E-03	014	6.9 E-02	015	5.71 E-02	016	7.36 E-02	
REGION			OIL C COST POWER PLANT ($/GAL)		GAS COST INDUSTRIAL ($/CU. FT.)		GAS COST POWER PLANT ($/CU. FT.)		COAL A HEAT CONTENT (BTU/TON)	
907		017	6.1 E	018	0.55 E-03	019	0.44 E-03	020	27. E+06	
REGION			COAL B HEAT CONTENT (BTU/TON)		COAL C HEAT CONTENT (BTU/TON)		OIL A HEAT CONTENT (BTU/GAL)		OIL B HEAT CONTENT (BTU/GAL)	
907		021	27. E+06	022	29. E+06	023	152. E+03	024	152. E+03	
REGION			OIL C HEAT CONTENT (BTU/GAL)		GAS HEAT CONTENT (BTU/CU. FT.)		COAL A SULFUR CONTENT (%)		COAL B SULFUR CONTENT (%)	
907		025	152. E+03	026	1000. E	027	2.0 E	028	1.0 E	
REGION			COAL C SULFUR CONTENT (%)		OIL A SULFUR CONTENT (%)		OIL B SULFUR CONTENT (%)		OIL C SULFUR CONTENT (%)	
907		029	0.5 E	030	2.0 E	031	1.0 E	032	0.5 E	
REGION			GAS SULFUR CONTENT (%)		COAL A ASH CONTENT (%)		COAL B ASH CONTENT (%)		COAL C ASH CONTENT (%)	
907		033	0.0 E	034	7.0 E	035	7.0 E	036	7.0 E	

Figure 8-4. Regional File Loadsheet

```
                    SOURCE    FILE
                  DICTIONARY   LISTING

001   DESCRIPTION FIELD (1 OF 2)                      A   13 CHARACTERS
002   DESCRIPTION FIELD (2 OF 2)                      A   11 CHARACTERS
003   LOCATION X                 KILOMETERS           N   0.00E 01 5.00E 02
004   LOCATION Y                 KILOMETERS           N   0.00E 01 5.00E 02
005   AREA                       SQ KILOMETERS        N   0.00E 01 1.50E 04
006   LINE X                     KILOMETERS           N   0.00E 01 5.00E 02
007   LINE Y                     KILOMETERS           N   0.00E 01 5.00E 02
008   POLITICAL JURISDICTION                          A   2 DIGITS
009   OWNERSHIP - 1 CHAR.        PRIV/LOC/ST/FED/UTIL C  PLSFU
010   SOURCE TYPE - 1 CHAR.      FURNACE/MFG/INCINER  C  BPS
011   STACK HEIGHT LIMIT         METERS               N   0.00E 01 5.00E 02
012   STACK HEIGHT               METERS               N   0.00E 01 5.00E 02
013   STACK DIAMETER             METERS               N   0.00E 01 2.00E 01
014   EXIT VELOCITY              METERS/SEC           N   0.00E 01 2.50E 01
015   EXIT TEMPERATURE           DEG. KELVIN          N   2.90E 02 1.00E 03
016   EXISTING CONTROL DEVICE                         A   3 DIGITS
017   EXISTING SO2 CONTROL EFF.  PERCENTAGE           N   0.00E 00 1.00E 02
018   EXISTING CO  CONTROL EFF.  PERCENTAGE           N   0.00E 00 1.00E 02
019   EXISTING PART. CONTROL EFF.PERCENTAGE           N   0.00E 00 1.00E 02
020   EXISTING -----* CONTR EFF. PERCENTAGE           N   0.00E 00 1.00E 02
021   EXHAUST GAS VOLUME         ACFM                 N   0.00E 00 3.00E 06
022   RATED CAPACITY             BTU/HR               N   0.00E 00 1.00E 11
023   OPERATING TIME             HRS/YR               N   0.00E 00 8.76E 03
024   SUMMER SHIFTS              SHIFTS/DAY           N   0.00E 00 3.00E 00
025   WINTER SHIFTS              SHIFTS/DAY           N   0.00E 00 3.00E 00
026   ANNUAL SHIFTS              SHIFTS/DAY           N   0.00E 00 3.00E 00
027   ORIGINAL COAL COST         $/TON                N   0.00E 00 2.50E 01
028   ORIGINAL OIL  COST         $/GAL                N   0.00E 00 2.00E-01
029   ORIGINAL GAS  COST         $/CU FT              N   0.00E 00 1.50E-03
030   ORIG  COAL HEAT   CONTENT  BTU/#                N   0.00E 00 3.50E 07
031   ORIG  OIL  HEAT   CONTENT  BTU/GAL              N   0.00E 00 2.00E 05
032   ORIG  GAS  HEAT   CONTENT  BTU/CU FT            N   0.00E 00 1.20E 03
033   ORIG  COAL SULFUR CONTENT  PERCENTAGE           N   0.00E 00 1.00E 01
034   ORIG  OIL  SULFUR CONTENT  PERCENTAGE           N   0.00E 00 5.00E 00
035   ORIG  GAS  SULFUR CONTENT  PERCENTAGE           N   0.00E 00 1.00E 00
036   ELECTRICITY COST           $/KW HR              N   0.00E 00 5.00E-02
037   DEVICE FUEL COST           $/CU FT              N   0.00E 00 1.50E-03
038   LIQUID COST                $/GAL                N   1.00E-04 3.00E-04
039   DISPOSAL FACTOR SO2        $/TON                N  -5.00E 00 5.00E 00
040   DISPOSAL FACTOR CO         $/TON                N  -5.00E 00 5.00E 00
041   DISPOSAL FACTOR PART.      $/TON                N  -5.00E 00 5.00E 00
042   DISPOSAL FACTOR -----*     $/TON                N  -5.00E 00 5.00E 00
043   MFG PROCESS UNITS - 1 CHAR TONS/BAR/BUSH/BAR/#  C  TAUCL
044   COAL RATE SUMMER           TONS/DAY             N   0.00E 00 1.00E 05
045   COAL RATE WINTER           TONS/DAY             N   0.00E 00 1.00E 05
046   COAL RATE ANNUAL           TONS/DAY             N   0.00E 00 1.00E 05
047   OIL RATE SUMMER            GAL/DAY              N   0.00E 00 1.50E 06
048   OIL RATE WINTER            GAL/DAY              N   0.00E 00 1.50E 06
049   OIL RATE ANNUAL            GAL/DAY              N   0.00E 00 1.50E 06
050   GAS RATE SUMMER            CU.FT/DAY            N   0.00E 00 1.70E 08
051   GAS RATE WINTER            CU.FT/DAY            N   0.00E 00 1.70E 08
052   GAS RATE ANNUAL            CU.FT/DAY            N   0.00E 00 1.70E 08
053   MATERIAL RATE SUMMER       PROC UNITS/DAY       N   0.00E 00 1.00E 06
054   MATERIAL RATE WINTER       PROC UNITS/DAY       N   0.00E 00 1.00E 06
055   MATERIAL RATE ANNUAL       PROC UNITS/DAY       N   0.00E 00 1.00E 06
056   EMISSION RATE SO2  SUMMER  TONS/DAY             N   0.00E 00 1.00E 03
057   EMISSION RATE SO2  WINTER  TONS/DAY             N   0.00E 00 1.00E 03
058   EMISSION RATE SO2  ANNUAL  TONS/DAY             N   0.00E 00 1.00E 03
059   EMISSION RATE CO   SUMMER  TONS/DAY             N   0.00E 00 1.00E 03
060   EMISSION RATE CO   WINTER  TONS/DAY             N   0.00E 00 1.00E 03
061   EMISSION RATE CO   ANNUAL  TONS/DAY             N   0.00E 00 1.00E 03
062   EMISSION RATE PART SUMMER  TONS/DAY             N   0.00E 00 1.00E 03
063   EMISSION RATE PART WINTER  TONS/DAY             N   0.00E 00 1.00E 03
064   EMISSION RATE PART ANNUAL  TONS/DAY             N   0.00E 00 1.00E 03
065   EMISSION RATE  -------*    TONS/DAY             N   0.00E 00 1.00E 03
066   EMISSION RATE  -------*    TONS/DAY             N   0.00E 00 1.00E 03
067   EMISSION RATE  -------*    TONS/DAY             N   0.00E 00 1.00E 03
```

Figure 8-5. Dictionary Input Format

```
                              DEVICE    FILE
                            DICTIONARY   LISTING

 001  DESCRIPTION FIELD (1 OF 2)                             A    13 CHARACTERS
 002  DESCRIPTION FIELD (2 OF 2)                             A    13 CHARACTERS
 003  MFG'S PRICE COEFF.  #1                                 N  -1.20E 03 1.00E 02
 004  MFG'S PRICE COEFF.  #2                                 N  -1.00E 01 1.50E 02
 005  MFG'S PRICE COEFF.  #3                                 N  -1.00E 01 1.00E 02
 006  TRANSPORTATION COST FACTOR PERCENTAGE                  N   0.00E 00 2.00E 02
 007  ERECTION COST FACTOR       PERCENTAGE                  N   0.00E 00 2.00E 02
 008  A & E COST FACTOR          PERCENTAGE                  N   0.00E 00 2.00E 02
 009  AUX EQUIP COST FACTOR      PERCENTAGE                  N   0.00E 00 2.00E 02
 010  UTIL CONN. COST FACTOR     PERCENTAGE                  N   0.00E 00 2.00E 02
 011  START-UP COST FACTOR       PERCENTAGE                  N   0.00E 00 2.00E 02
 012  SPARE PARTS COST FACTOR    PERCENTAGE                  N   0.00E 00 2.00E 02
 013  LAND & BLDGS COST FACTOR   PERCENTAGE                  N   0.00E 00 2.00E 02
 014  TOTAL INST COST FACTOR     PERCENTAGE                  N   0.00E 00 5.00E 02
 015  LIFE                       YEARS                       N   0.00E 00 3.00E 01
 016  PRESS. DROP                IN. H20                     N   0.00E 00 8.00E 01
 017  LABOR QTY  SM PLANT        HRS LBR/HR OF OPER          N   0.00E 00 1.00E 00
 018  LABOR QTY MED PLANT        HRS LBR/HR OF OPER          N   0.00E 00 3.00E 00
 019  LABOR QTY  LARGE PLANT     HRS LBR/HR OF OPER          N   5.00E-01 5.00E 00
 020  LABOR QTY  X-LARGE PLANT   HRS LBR/HR OF OPER          N   1.00E 00 1.00E 01
 021  CHEM COST                  $/TON                       N   0.00E 00 1.00E 07
 022  DISPOSAL COST/CREDIT SO2   $/TON                       N  -3.00E 01 5.00E 00
 023  DISPOSAL COST/CREDIT CO    $/TON                       N  -5.00E 00 5.00E 00
 024  DISPOSAL COST/CREDIT PART  $/TON                       N  -5.00E-01 5.00E 00
 025  DISPOSAL COST/CREDIT OTHER $/TON                       N  -1.00E 07 1.00E 07
 026  DEVICE FUEL FACTOR                                     N   0.00E 00 1.20E 00
 027  RATED EFF  SO2             PERCENTAGE                  N   0.00E 00 1.00E 02
 028  RATED EFF  CO              PERCENTAGE                  N   0.00E 00 1.00E 02
 029  RATED EFF  PART.           PERCENTAGE                  N   0.00E 00 1.00E 02
 030  RATED EFF  OTHER           PERCENTAGE                  N   0.00E 00 1.00E 02
```

Figure 8-5. Dictionary Input Format (Continued)

```
                                   REGION    FILE
                                DICTIONARY   LISTING
001  LABOR COST                         $/HR                N   2.00E 00 5.00E 00
002  SALES TAX    A                     PERCENTAGE          N   0.00E 00 1.00E 01
003  SALES TAX    B                     PERCENTAGE          N   0.00E 00 1.00E 01
004  SALES TAX    C                     PERCENTAGE          N   0.00E 00 1.00E 01
005  INTEREST RATE                      PERCENTAGE          N   0.00E 00 1.50E 01
006  COAL A   COST   INDUSTRIAL         $/TON               N   1.00E 00 1.50E 01
007  COAL A   COST   POWER PLANT        $/TON               N   1.00E 00 1.50E 01
008  COAL B   COST   INDUSTRIAL         $/TON               N   1.00E 00 1.50E 01
009  COAL B   COST   POWER PLANT        $/TON               N   1.00E 00 1.50E 01
010  COAL C   COST   INDUSTRIAL         $/TON               N   1.00E 00 1.50E 01
011  COAL C   COST   POWER PLANT        $/TON               N   1.00E 00 1.50E 01
012  OIL A    COST   INDUSTRIAL         $/GAL               N   1.00E-02 2.00E-01
013  OIL A    COST   POWER PLANT        $/GAL               N   1.00E-02 2.00E-01
014  OIL B    COST   INDUSTRIAL         $/GAL               N   1.00E-02 2.00E-01
015  OIL B    COST   POWER PLANT        $/GAL               N   1.00E-02 2.00E-01
016  OIL C    COST   INDUSTRIAL         $/GAL               N   1.00E-02 2.00E-01
017  OIL C    COST   POWER PLANT        $/GAL               N   1.00E-02 2.00E-01
018  GAS COST   INDUSTRIAL              $/CU.FT             N   1.00E-04 1.50E-03
019  GAS COST   POWER PLANT             $/CU.FT             N   1.00E-04 1.50E-03
020  COAL A   HEAT CONTENT              BTU/TON             N   1.00E 07 3.50E 07
021  COAL B   HEAT CONTENT              BTU/TON             N   1.00E 07 3.50E 07
022  COAL C   HEAT CONTENT              BTU/TON             N   1.00E 07 3.50E 07
023  OIL A    HEAT CONTENT              BTU/GAL             N   1.00E 05 2.00E 05
024  OIL B    HEAT CONTENT              BTU/GAL             N   1.00E 05 2.00E 05
025  OIL C    HEAT CONTENT              BTU/GAL             N   1.00E 05 2.00E 05
026  GAS HEAT CONTENT                   BTU/CU.FT           N   1.00E 02 1.20E 03
027  COAL A   SULPHUR CONTENT           PERCENTAGE          N   3.00E-01 3.00E 00
028  COAL B   SULPHUR CONTENT           PERCENTAGE          N   3.00E-01 3.00E 00
029  COAL C   SULPHUR CONTENT           PERCENTAGE          N   3.00E-01 3.00E 00
030  OIL A    SULPHUR CONTENT           PERCENTAGE          N   3.00E-01 3.00E 00
031  OIL B    SULPHUR CONTENT           PERCENTAGE          N   3.00E-01 3.00E 00
032  OIL C    SULPHUR CONTENT           PERCENTAGE          N   3.00E-01 3.00E 00
033  GAS SULPHUR CONTENT                PERCENTAGE          N   0.00E 00 1.00E 00
034  COAL A   ASH CONTENT               PERCENTAGE          N   1.00E 00 2.00E 01
035  COAL B   ASH CONTENT               PERCENTAGE          N   1.00E 00 2.00E 01
036  COAL C   ASH CONTENT               PERCENTAGE          N   1.00E 00 2.00E 01
```

Figure 8-5 Dictionary Input Format (Continued)

```
     JOB CONTROL STREAM TO  LOAD  SOURCE DICTIONARY

//        EXEC  PGM=IEBGENER
//SYSPRINT DD   SYSOUT=A
//SYSIN     DD  DUMMY
//SYSUT2    DD  DSNAME=SORC-D,VOL=SER=000078,UNIT=2314,
//              DCB=(RECFM=F,LRECL=80,BLKSIZE=80),
//              SPACE=(TRK,(1,1)),
//              DISP=(OLD,PASS)
//SYSUT1    DD  *
   INSERT SOURCE DICTIONARY IN PLACE OF THIS CARD

//        EXEC  PGM=IEBPTPCH
//SYSUT1     DD DSNAME=SORC-D,VOL=SER=000078,UNIT=2314,
//              DCB=(RECFM=FB,LRECL=80,BLKSIZE=80),
//              DISP=(OLD,PASS)
//SYSUT2     DD SYSOUT=A
//SYSPRINT   DD SYSOUT=A
//SYSIN      DD *
     PRINT      MAXFLDS=6,MAXLINE=56
     TITLE      ITEM=('SOURCE FILE DICTIONARY',57)
     TITLE      ITEM=('BY FLD NO, DESCR, UNITS, CODE, & LIMITS',48)
     RECORD     FIELD=(3,1,,28),FIELD=(27,4,,34),FIELD=(20,31,,63),
                FIELD=(1,51,,85),FIELD=(9,52,,88),FIELD=(9,61,,99)

     JOB CONTROL STREAM TO  LOAD  DEVICE DICTIONARY

//        EXEC  PGM=IEBGENER
//SYSPRINT DD   SYSOUT=A
//SYSIN     DD  DUMMY
//SYSUT2    DD  DSNAME=DVICE-D,VOL=SER=000078,UNIT=2314,
//              DCB=(RECFM=F,LRECL=80,BLKSIZE=80),
//              SPACE=(TRK,(1,1)),
//              DISP=(OLD,PASS)
//SYSUT1    DD  *
   INSERT DEVICE DICTIONARY IN PLACE OF THIS CARD

//        EXEC  PGM=IEBPTPCH
//SYSUT1     DD DSNAME=DVICE-D,VOL=SER=000078,UNIT=2314,
//              DCB=(RECFM=FB,LRECL=80,BLKSIZE=80),
//              DISP=(OLD,PASS)
//SYSUT2     DD SYSOUT=A
//SYSPRINT   DD SYSOUT=A
//SYSIN      DD *
     PRINT      MAXFLDS=6,MAXLINE=56
     TITLE      ITEM=('DEVICE FILE DICTIONARY',57)
     TITLE      ITEM=('BY FLD NO, DESCR, UNITS, CODE, & LIMITS',48)
     RECORD     FIELD=(3,1,,28),FIELD=(27,4,,34),FIELD=(20,31,,63),
                FIELD=(1,51,,85),FIELD=(9,52,,88),FIELD=(9,61,,99)
```

Figure 8-6. Information System JCL Inputs

```
     JOB CONTROL STREAM TO  LOAD  REGION DICTIONARY

//          EXEC  PGM=IEBGENER
//SYSPRINT  DD    SYSOUT=A
//SYSIN     DD    DUMMY
//SYSUT2    DD    DSNAME=REGN-D,VOL=SER=000078,UNIT=2314,
//                DCB=(RECFM=F,LRECL=80,BLKSIZE=80),
//                SPACE=(TRK,(1,1)),
//                DISP=(OLD,PASS)
//SYSUT1    DD    *
    INSERT REGION DICTIONARY IN PLACE OF THIS CARD

//          EXEC  PGM=IEBPTPCH
//SYSUT1      DD DSNAME=REGN-D,VOL=SER=000078,UNIT=2314,
//                DCB=(RECFM=FB,LRECL=80,BLKSIZE=80),
//                DISP=(OLD,PASS)
//SYSUT2      DD SYSOUT=A
//SYSPRINT    DD SYSOUT=A
//SYSIN       DD *
      PRINT       MAXFLDS=6,MAXLINE=56
      TITLE       ITEM=('REGION FILE DICTIONARY',57)
      TITLE       ITEM=('BY FLD NO, DESCR, UNITS, CODE, & LIMITS',48)
      RECORD      FIELD=(3,1,,28),FIELD=(27,4,,34),FIELD=(20,31,,63),
                  FIELD=(1,51,,85),FIELD=(9,52,,88),FIELD=(9,61,,99)
```

Figure 8-6. Information System JCL Inputs (Continued)

```
     JOB CONTROL STREAM TO UPDATE REGION DATA FILE

//          EXEC SORTD
//SORTWK01 DD  UNIT=SYSDA,SPACE=(CYL,(10),,CONTIG)
//SORTWK02 DD  UNIT=SYSDA,SPACE=(CYL,(10),,CONTIG)
//SORTWK03 DD  UNIT=SYSDA,SPACE=(CYL,(10),,CONTIG)
//SORTOUT  DD  DSNAME=&DATAIN,UNIT=SYSDA,
//             DCB=(RECFM=FB,LRECL=80,BLKSIZE=800),
//             SPACE=(CYL,(1,1)),
//             DISP=(NEW,PASS)
//SYSIN    DD  *
 SORT FIELDS=(1.0,11.0,CH,A),SIZE=E1000
 END

//SORTIN   DD  *,DCB=(RECFM=F,LRECL=80,BLKSIZE=80)
   INSERT REGION DATA IN PLACE OF THIS CARD

//         EXEC  PGM=RAPEDT
//STEPLIB  DD  DSNAME=EDT-PDS,VOLUME=SER=000078,UNIT=2314,
//             DISP=(OLD,PASS)
//PRTOUT DD SYSOUT=A
//DATOUT DD DSNAME=&DATOUT,UNIT=SYSDA,
//             DCB=(RECFM=FB,LRECL=80,BLKSIZE=800),
//             SPACE=(CYL,(1,1)),
//             DISP=(NEW,PASS)
//DICTIN   DD  DSNAME=REGN-D,VOL=SER=000078,UNIT=2314,
//             DCB=(RECFM=F,LRECL=80,BLKSIZE=80),
//             DISP=(OLD,PASS)
//DATAIN   DD  DSNAME=&DATAIN,UNIT=SYSDA,
//             DCB=(RECFM=FB,LRECL=80,BLKSIZE=800),
//             DISP=(OLD,PASS)
//SYSIN  DD  *
  INSERT DATE CARD IN PLACE OF THIS CARD - USE 1ST 18 POSITIONS FOR DATE.
```

Figure 8-6. Information System JCL Inputs (Continued)

```
//          EXEC   PGM=IEBDG
//SYSUT1    DD  DSNAME=R-907,VOL=SER=000078,UNIT=2314,
//              DCB=(RECFM=FB,LRECL=546,BLKSIZE=3276),
//              DISP=(OLD,PASS)
//SYSUT2    DD  DSNAME=REGN-T,UNIT=2400,
//              DCB=(RECFM=FB,LRECL=962,BLKSIZE=5772),
//              LABEL=(,NL),
//              DISP=(NEW,PASS)
//SYSPRINT  DD   SYSOUT=A
//SYSIN     DD  *
  DSD     OUTPUT=(SYSUT2),INPUT=(SYSUT1)
  CREATE FILL=' ',INPUT=SYSUT1
  END

//        EXEC  PGM=RAPUPD
//STEPLIB   DD  DSNAME=UPD-PDS,VOLUME=SER=000078,UNIT=2314,
//              DISP=(OLD,PASS)
//MAFILE    DD  DSNAME=REGN-T,UNIT=2400,
//              DCB=(RECFM=FB,LRECL=962,BLKSIZE=5772),
//              LABEL=(,NL),
//              DISP=(OLD,PASS)
//NUFILE    DD  DSNAME=R-907,VOL=SER=000078,UNIT=2314,

//              DCB=(RECFM=FB,LRECL=546,BLKSIZE=3276),
//              SPACE=(CYL,(1,1)),
//              DISP=(OLD,KEEP)
//PRFILE DD SYSOUT=A
//TRFILE DD DSNAME=&DATOUT,UNIT=SYSDA,
//              DCB=(RECFM=FB,LRECL=80,BLKSIZE=800),
//              DISP=(OLD,PASS)
//SYSIN  DD  *
  INSERT DATE CARD IN PLACE OF THIS CARD - USE 1ST 18 POSITIONS
```

Figure 8-6 (Continued)

```
     JOB CONTROL STREAM TO UPDATE DEVICE DATA FILE

//          EXEC SORTD
//SORTWK01 DD  UNIT=SYSDA,SPACE=(CYL,(10),,CONTIG)
//SORTWK02 DD  UNIT=SYSDA,SPACE=(CYL,(10),,CONTIG)
//SORTWK03 DD  UNIT=SYSDA,SPACE=(CYL,(10),,CONTIG)
//SORTOUT  DD  DSNAME=&DATAIN,UNIT=SYSDA,
//             DCB=(RECFM=FB,LRECL=80,BLKSIZE=800),
//             SPACE=(CYL,(1,1)),
//             DISP=(NEW,PASS)
//SYSIN    DD  *
 SORT FIELDS=(1.0,11.0,CH,A),SIZE=E1000
 END

//SORTIN   DD  *,DCB=(RECFM=F,LRECL=80,BLKSIZE=80)
   INSERT DEVICE DATA IN PLACE OF THIS CARD

//         EXEC  PGM=RAPEDT
//STEPLIB  DD  DSNAME=EDT-PDS,VOLUME=SER=000078,UNIT=2314,
//             DISP=(OLD,PASS)
//PRTOUT DD SYSOUT=A
//DATOUT DD DSNAME=&DATOUT,UNIT=SYSDA,
//             DCB=(RECFM=FB,LRECL=80,BLKSIZE=800),
//             SPACE=(CYL,(1,1)),
//             DISP=(NEW,PASS)
//DICTIN   DD  DSNAME=DVICE-D,VOL=SER=000078,UNIT=2314,
//             DCB=(RECFM=F,LRECL=80,BLKSIZE=80),
//             DISP=(OLD,PASS)
//DATAIN   DD  DSNAME=&DATAIN,UNIT=SYSDA,
//             DCB=(RECFM=FB,LRECL=80,BLKSIZE=800),
//             DISP=(OLD,PASS)
//SYSIN  DD  *
  INSERT DATE CARD IN PLACE OF THIS CARD - USE 1ST 18 POSITIONS
```

Figure 8-6 (Continued)

```
//           EXEC   PGM=IEBDG
//SYSUT1    DD   DSNAME=D-907,VOL=SER=000078,UNIT=2314,
//                DCB=(RECFM=FB,LRECL=468,BLKSIZE=2808),
//                DISP=(OLD,PASS)
//SYSUT2    DD   DSNAME=DVICE-T,UNIT=2400,
//                DCB=(RECFM=FB,LRECL=962,BLKSIZE=5772),
//                LABEL=(,NL),
//                DISP=(NEW,PASS)
//SYSPRINT  DD   SYSOUT=A
//SYSIN  DD *
 DSD      OUTPUT=(SYSUT2),INPUT=(SYSUT1)
  CREATE FILL=' ',INPUT=SYSUT1
  END

//         EXEC   PGM=RAPUPD
//STEPLIB   DD   DSNAME=UPD-PDS,VOLUME=SER=000078,UNIT=2314,
//                DISP=(OLD,PASS)
//SYSABEND  DD   SYSOUT=A
//MAFILE    DD   DSNAME=DVICE-T,UNIT=2400,
//                DCB=(RECFM=FB,LRECL=962,BLKSIZE=5772),
//                LABEL=(,NL),
//                DISP=(OLD,PASS)
//NUFILE    DD   DSNAME=D-907,VOL=SER=000078,UNIT=2314,
//                DCB=(RECFM=FB,LRECL=468,BLKSIZE=2808),
//                SPACE=(CYL,(1,1)),
//                DISP=(OLD,PASS)
//PRFILE DD SYSOUT=A
//TPFILE DD DSNAME=&DATOUT,UNIT=SYSDA,
//                DCB=(RECFM=FB,LRECL=80,BLKSIZE=800),
//                DISP=(OLD,PASS)
//SYSIN  DD  *
  INSERT DATE CARD IN PLACE OF THIS CARD - USE 1ST 18 POSITIONS
```

Figure 8-6 (Continued)

JOB CONTROL STREAM TO UPDATE SOURCE DATA FILE

```
//          EXEC SORTD
//SORTWK01 DD  UNIT=SYSDA,SPACE=(CYL,(10),,CONTIG)
//SORTWK02 DD  UNIT=SYSDA,SPACE=(CYL,(10),,CONTIG)
//SORTWK03 DD  UNIT=SYSDA,SPACE=(CYL,(10),,CONTIG)
//SORTOUT  DD  DSNAME=&DATAIN,UNIT=SYSDA,
//             DCB=(RECFM=FB,LRECL=80,BLKSIZE=800),
//             SPACE=(CYL,(1,1)),
//             DISP=(NEW,PASS)
//SYSIN    DD  *
 SORT FIELDS=(1.0,11.0,CH,A),SIZE=E1000
 END

//SORTIN   DD  *,DCB=(RECFM=F,LRECL=80,BLKSIZE=80)
   INSERT SOURCE DATA IN PLACE OF THIS CARD

//         EXEC  PGM=RAPEDT
//STEPLIB  DD  DSNAME=EDT-PDS,VOLUME=SER=000078,UNIT=2314,
//             DISP=(OLD,PASS)
//PRTOUT DD SYSOUT=A
//DATOUT DD DSNAME=&DATOUT,UNIT=SYSDA,
//             DCB=(RECFM=FB,LRECL=80,BLKSIZE=800),
//             SPACE=(CYL,(1,1)),
//             DISP=(NEW,PASS)
//DICTIN  DD  DSNAME=SORC-D,VOL=SER=000078,UNIT=2314,
//             DCB=(RECFM=F,LRECL=80,BLKSIZE=80),
//             DISP=(OLD,PASS)
//DATAIN  DD  DSNAME=&DATAIN,UNIT=SYSDA,
//             DCB=(RECFM=FB,LRECL=80,BLKSIZE=800),
//             DISP=(OLD,PASS)
//SYSIN  DD  *
  INSERT DATE CARD IN PLACE OF THIS CARD - USE 1ST 18 POSITIONS
```

Figure 8-6 (Continued)

```
//         EXEC   PGM=IEBGENER
//SYSUT1    DD   DSNAME=S-907,VOL=SER=000078,UNIT=2314,
//               DCB=(RECFM=FB,LRECL=962,BLKSIZE=5772),
//               DISP=(OLD,PASS)
//SYSUT2    DD   DSNAME=SORC-T,UNIT=2400,
//               DCB=(RECFM=FB,LRECL=962,BLKSIZE=5772),
//               LABEL=(,NL),
//               DISP=(NEW,PASS)
//SYSPRINT  DD   SYSOUT=A
//SYSIN   DD   DUMMY

//         EXEC   PGM=RAPUPD
//STEPLIB   DD   DSNAME=UPD-PDS,VOLUME=SER=000078,UNIT=2314,
//               DISP=(OLD,PASS)
//MAFILE    DD   DSNAME=SORC-T,UNIT=2400,
//               DCB=(RECFM=FB,LRECL=962,BLKSIZE=5772),
//               LABEL=(,NL),
//               DISP=(OLD,PASS)
//NUFILE    DD   DSNAME=S-907,VOL=SER=000078,UNIT=2314,
//               DCB=(RECFM=FB,LRECL=962,BLKSIZE=5772),
//               SPACE=(CYL,(1,1)),
//               DISP=(OLD,KEEP)
//PRFILE DD SYSOUT=A
//TRFILE DD DSNAME=&DATOUT,UNIT=SYSDA,
//               DCB=(RECFM=FB,LRECL=80,BLKSIZE=800),
//               DISP=(OLD,PASS)
//SYSABEND  DD   SYSOUT=A
//SYSIN  DD   *
  INSERT DATE CARD IN PLACE OF THIS CARD - USE 1ST 18 POSITIONS
```

Figure 8-6 (Continued)

JOB CONTROL STREAM TO LIST SOURCE DATA FILE

```
//         EXEC  PGM=DATLST
//STEPLIB   DD   DSNAME=LST-PDS,VOLUME=SER=000078,UNIT=2314,
//               DISP=(OLD,PASS)
//MAFILE    DD   DSNAME=S-907,VOL=SER=000078,UNIT=2314,
//               DCB=(RECFM=FB,LRECL=962,BLKSIZE=5772),
//               DISP=(OLD,KEEP)
//PRFILE  DD SYSOUT=A
//DICTIN  DD   DSNAME=SORC-D,VOL=SER=000078,UNIT=2314,
//               DCB=(RECFM=F,LRECL=80,BLKSIZE=80),
//               DISP=(OLD,PASS)
```

JOB CONTROL STREAM TO LIST DEVICE DATA FILE

```
//         EXEC  PGM=DATLST
//STEPLIB   DD   DSNAME=LST-PDS,VOLUME=SER=000078,UNIT=2314,
//               DISP=(OLD,PASS)
//MAFILE    DD   DSNAME=D-907,VOL=SER=000078,UNIT=2314,
//               DCB=(RECFM=FB,LRECL=468,BLKSIZE=2808),
//               DISP=(OLD,PASS)
//PRFILE  DD SYSOUT=A
//DICTIN  DD   DSNAME=DVICE-D,VOL=SER=000078,UNIT=2314,
//               DCB=(RECFM=F,LRECL=80,BLKSIZE=80),
//               DISP=(OLD,PASS)
```

JOB CONTROL STREAM TO LIST REGION DATA FILE

```
//         EXEC  PGM=DATLST
//STEPLIB   DD   DSNAME=LST-PDS,VOLUME=SER=000078,UNIT=2314,
//               DISP=(OLD,PASS)
//MAFILE    DD   DSNAME=R-907,VOL=SER=000078,UNIT=2314,
//               DCB=(RECFM=FB,LRECL=546,BLKSIZE=3276),
//               DISP=(OLD,PASS)
//PRFILE  DD SYSOUT=A
//DICTIN  DD   DSNAME=REGN-D,VOL=SER=000078,UNIT=2314,
//               DCB=(RECFM=F,LRECL=80,BLKSIZE=80),
//               DISP=(OLD,PASS)
```

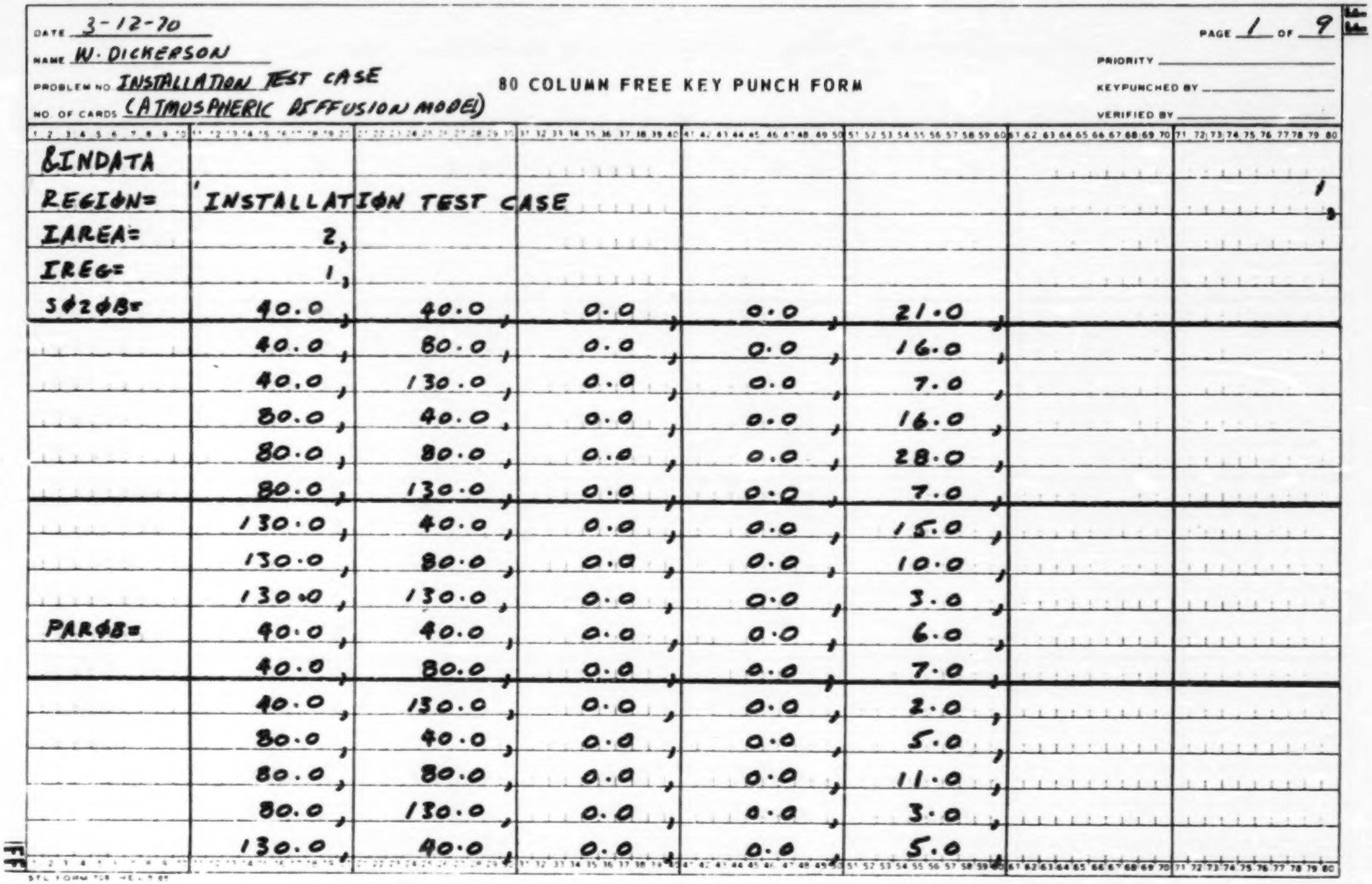
JOB CONTROL STREAM TO PRODUCE SOURCE DATA SUMMARIES

```
//         EXEC  PGM=SUMRY1
//         EXEC  PGM=SUMRY2
//         EXEC  PGM=SUMRY3
   USE ONLY ONE OF THE PRECEDING CARDS AS APPLICABLE
//STEPLIB  DD  DSNAME=SUM-PDS,VOLUME=SER=000078,UNIT=2314,
//             DISP=(OLD,KEEP)
//FILEIN      DD DSNAME=S-907,VOL=SER=000078,UNIT=2314,
//             DCB=(RECFM=FB,LRECL=962,BLKSIZE=5772),
//             DISP=(OLD,KEEP)
//FILEOUT      DD  SYSOUT=A
//SYSOUT  DD  SYSOUT=A
```

Figure 8-6 (Continued)

```
//             JOB NUMBER
//             ACCOUNTING INFORMATION
                                       .
                                       .
                                       .
//CLG    EXEC  FORTGCLG,PARM.FORT=(MAP,DECK,LIST),
//             PARM.LKED='OVLY,LET,MAP,SIZE=(96K,12K)'
//FORT.SYSIN   DD *
                                       .
                                       .
                                       .
               FORTRAN SOURCE DECK OF TRANSPORT AND DIFFUSION MODEL
                                       .
                                       .
                                       .
 /*
//LKED.SYSIN   DD *
 OVERLAY  A
 INSERT CONVRT,INPUT,IHCNAMEL
 OVERLAY  A
 INSERT DIFMOD
 OVERLAY B
 INSERT CAMP,REG,POLUT1
 OVERLAY B
 INSERT POLUT
 OVERLAY B
 INSERT EXCEED,ORDER,PLOT
 OVERLAY  A
 INSERT SELECT,SEL12,POLUT2,ZVALU2
 /*
//GO.FT11F001  DD  DSN=S-907,VOL=SER=000078,UNIT=2314,DISP=OLD
//GO.FT12F001 DD UNIT=2400,DSNAME=KAY,DISP=(NEW,KEEP),
//             LABEL=(,NL,,OUT),DCB=(BLKSIZE=196,LRECL=192,RECFM=VS)
//GO.FT13F001  DD DSNAME=MT007-1,VOL=SER=000078,UNIT=2314,
//             DCB=(RECFM=FB,LRECL=80,BLKSIZE=800),
//             DISP=(OLD,PASS)
//GO.FT14F001  DD DSNAME=MT007-2,VOL=SER=000078,UNIT=2314,
//             DCB=(RECFM=FB,LRECL=80,BLKSIZE=800),
//             DISP=(OLD,PASS)
//GO.SYSUDUMP  DD  SYSOUT=A
//GO.SYSIN     DD *
 &INDATA
                                       .
                                       .
                                       .
               NAMELIST INPUT DATA DECK
                                       .
                                       .
                                       .
 &END
 /*
```

Figure 8-7. Atmospheric Diffusion Model - JCL Inputs



DATE 3-12-70
NAME W. DICKERSON
PROBLEM NO INSTALLATION TEST CASE
NO. OF CARDS (ATMOSPHERIC DIFFUSION MODEL)

80 COLUMN FREE KEY PUNCH FORM

PAGE 1 OF 9
PRIORITY
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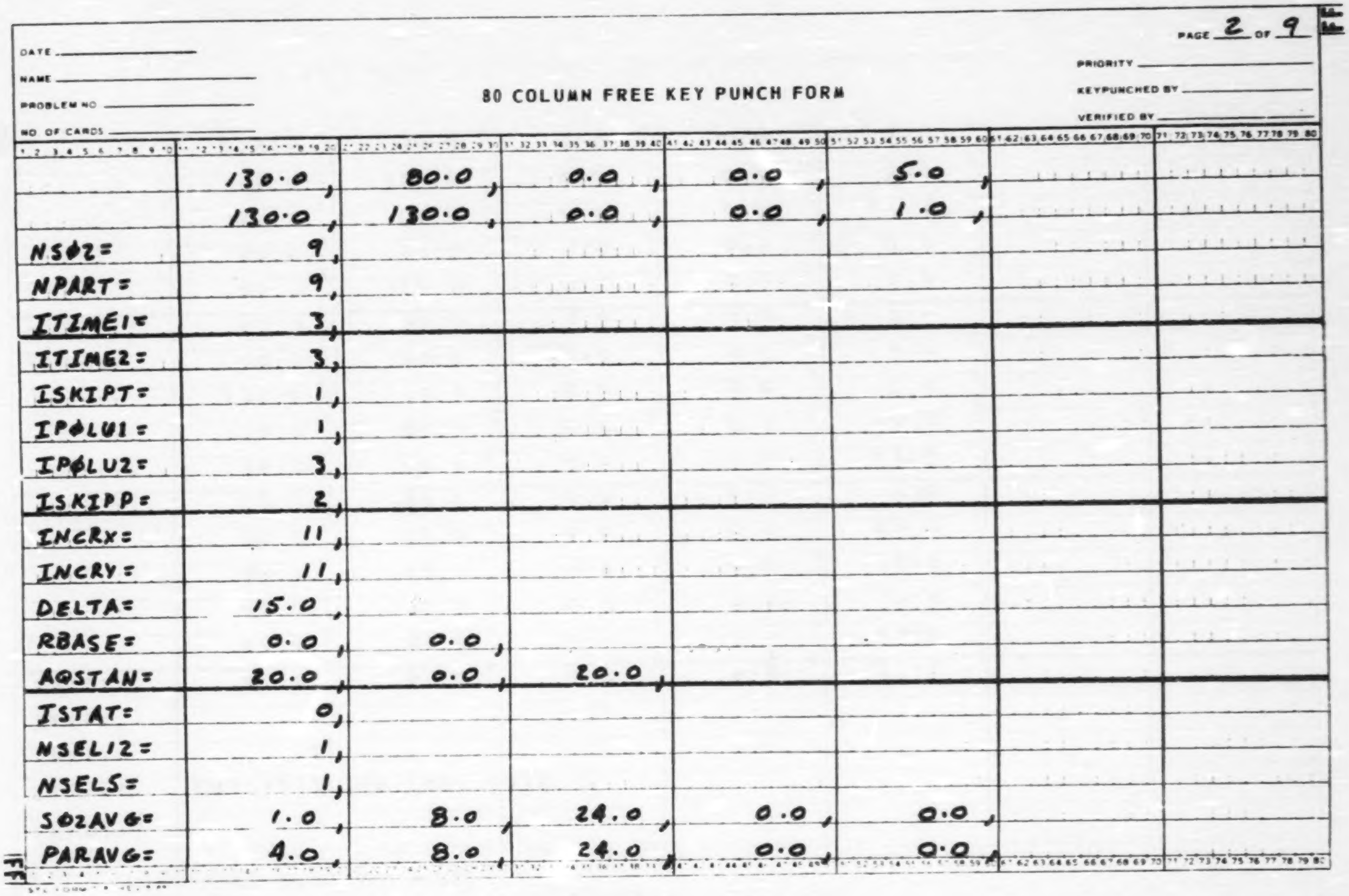
```
&INDATA
REGION=   'INSTALLATION TEST CASE                                          ',
IAREA=             2,
IREG=              1,
SO2OB=          40.0,     40.0,      0.0,      0.0,     21.0,
                40.0,     80.0,      0.0,      0.0,     16.0,
                40.0,    130.0,      0.0,      0.0,      7.0,
                80.0,     40.0,      0.0,      0.0,     16.0,
                80.0,     80.0,      0.0,      0.0,     28.0,
                80.0,    130.0,      0.0,      0.0,      7.0,
               130.0,     40.0,      0.0,      0.0,     15.0,
               130.0,     80.0,      0.0,      0.0,     10.0,
               130.0,    130.0,      0.0,      0.0,      3.0,
PAROB=          40.0,     40.0,      0.0,      0.0,      6.0,
                40.0,     80.0,      0.0,      0.0,      7.0,
                40.0,    130.0,      0.0,      0.0,      2.0,
                80.0,     40.0,      0.0,      0.0,      5.0,
                80.0,     80.0,      0.0,      0.0,     11.0,
                80.0,    130.0,      0.0,      0.0,      3.0,
               130.0,     40.0,      0.0,      0.0,      5.0,
```

Figure 8-8. Atmospheric Diffusion Model - Namelist Inputs



DATE ______

NAME ______

PROBLEM NO ______

NO OF CARDS ______

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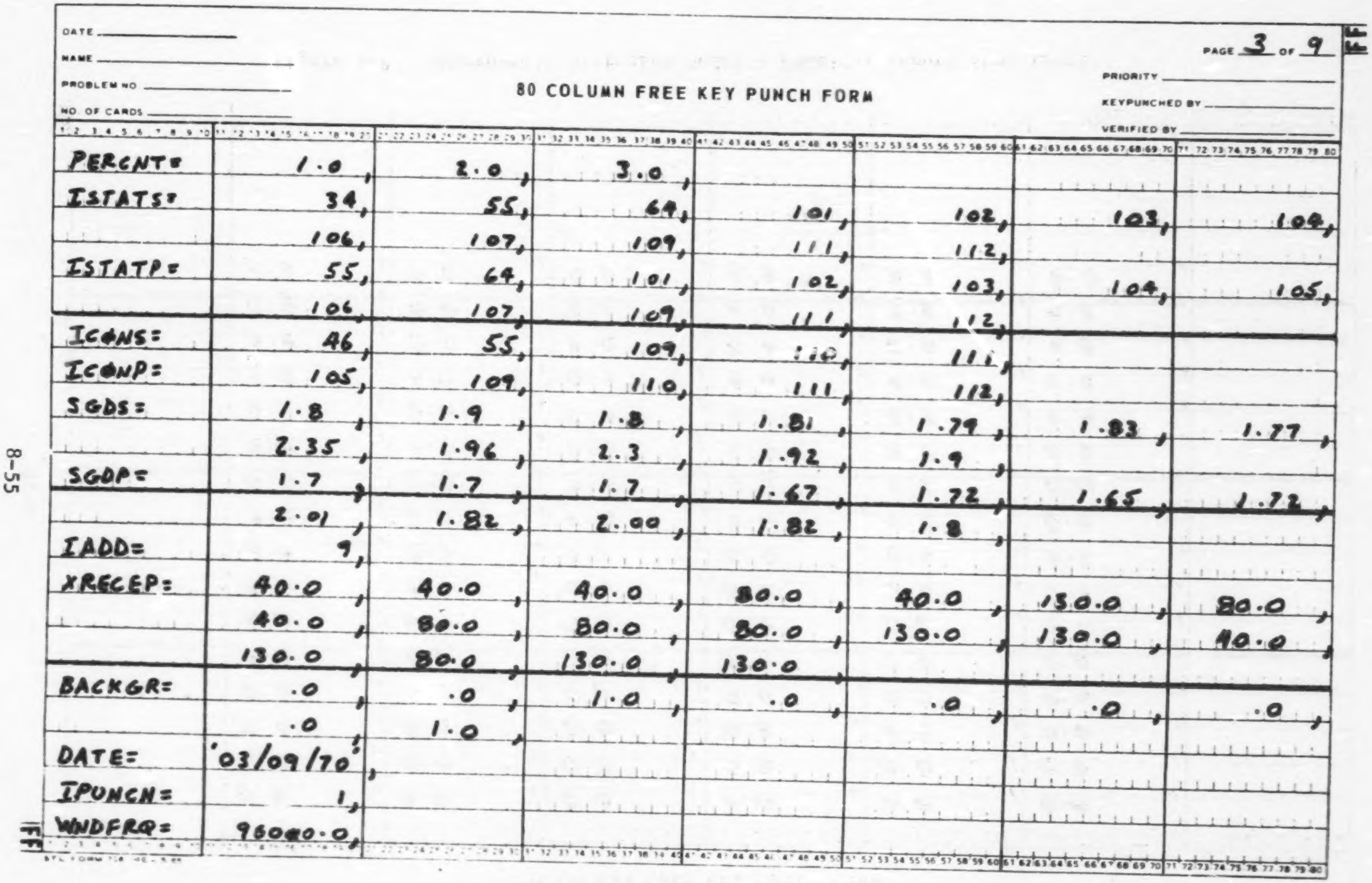
	130.0,	80.0,	0.0,	0.0,	5.0,		
	130.0,	130.0,	0.0,	0.0,	1.0,		
NSØ2=	9,						
NPART=	9,						
ITIME1=	3,						
ITIME2=	3,						
ISKIPT=	1,						
IPØLU1=	1,						
IPØLU2=	3,						
ISKIPP=	2,						
INCRX=	11,						
INCRY=	11,						
DELTA=	15.0,						
RBASE=	0.0,	0.0,					
AQSTAN=	20.0,	0.0,	20.0,				
ISTAT=	0,						
NSEL12=	1,						
NSELS=	1,						
SØ2AVG=	1.0,	8.0,	24.0,	0.0,	0.0,		
PARAVG=	4.0,	8.0,	24.0,	0.0,	0.0,		

Figure 8-8. Atmospheric Diffusion Model - Namelist Inputs (Continued)



DATE
NAME
PROBLEM NO
NO. OF CARDS

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PRIORITY
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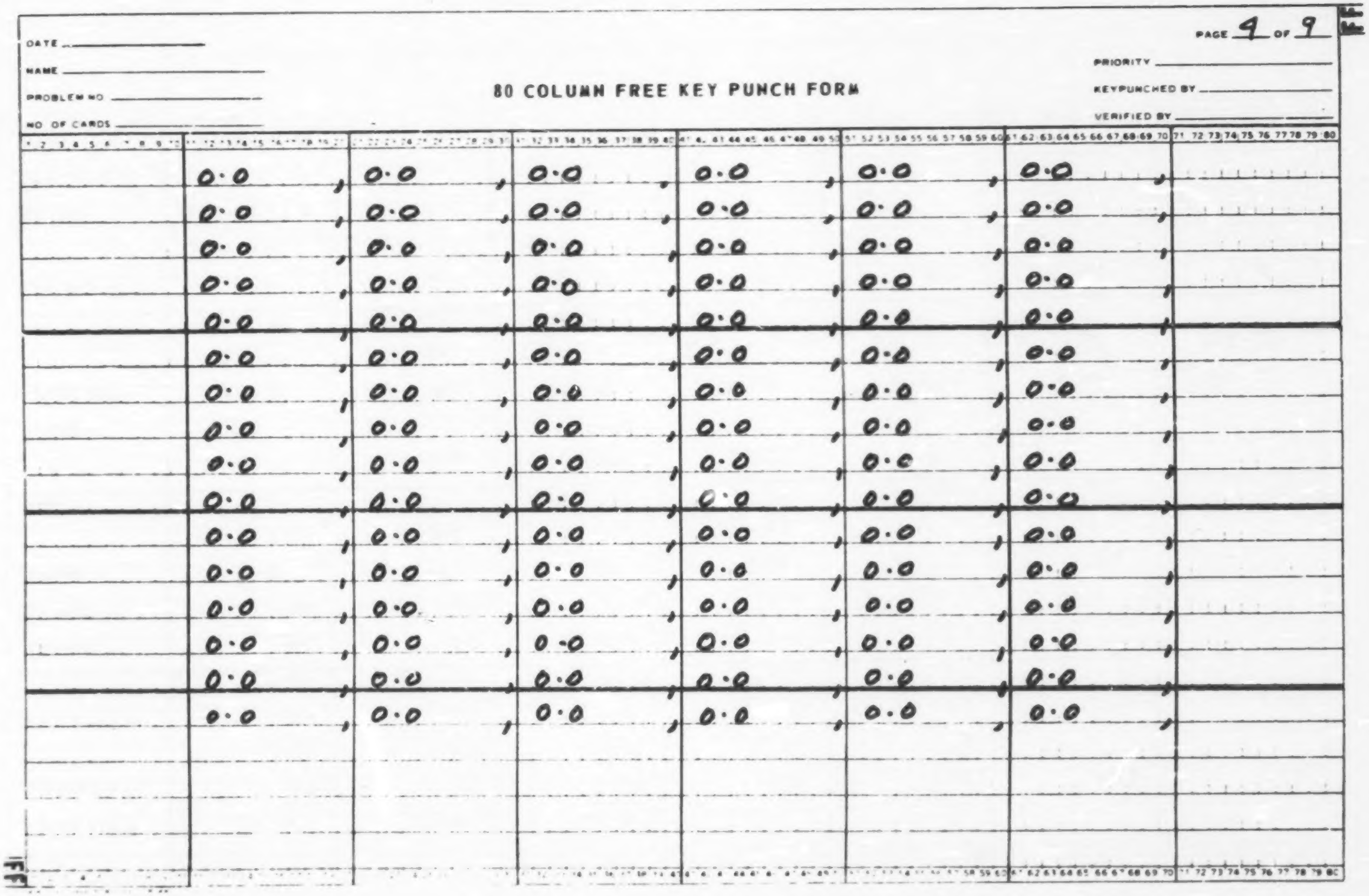
1 2 3 4 5 6 7 8 9 10	11 12 13 14 15 16 17 18 19 20	21 22 23 24 25 26 27 28 29 30	31 32 33 34 35 36 37 38 39 40	41 42 43 44 45 46 47 48 49 50	51 52 53 54 55 56 57 58 59 60	61 62 63 64 65 66 67 68 69 70	71 72 73 74 75 76 77 78 79 80
PERCNT=	1.0 ,	2.0 ,	3.0 ,				
ISTATS=	34,	55,	64,	101,	102,	103,	104,
	106,	107,	109,	111,	112,		
ISTATP=	55,	64,	101,	102,	103,	104,	105,
	106,	107,	109,	111,	112,		
ICONS=	46,	55,	109,	110,	111,		
ICONP=	105,	109,	110,	111,	112,		
SGDS=	1.8 ,	1.9 ,	1.8 ,	1.81 ,	1.79 ,	1.83 ,	1.77 ,
	2.35 ,	1.96 ,	2.3 ,	1.92 ,	1.9 ,		
SGDP=	1.7 ,	1.7 ,	1.7 ,	1.67 ,	1.72 ,	1.65 ,	1.72 ,
	2.01 ,	1.82 ,	2.00 ,	1.82 ,	1.8 ,		
IADD=	9,						
XRECEP=	40.0 ,	40.0 ,	40.0 ,	80.0 ,	40.0 ,	130.0 ,	80.0 ,
	40.0 ,	80.0 ,	80.0 ,	80.0 ,	130.0 ,	130.0 ,	40.0 ,
	130.0 ,	80.0 ,	130.0 ,	130.0 ,			
BACKGR=	.0 ,	.0 ,	1.0 ,	.0 ,	.0 ,	.0 ,	.0 ,
	.0 ,	1.0 ,					
DATE=	'03/09/70',						
IPUNCH=	1,						
WNDFRQ=	96000.0,						

Figure 8-8. Atmospheric Diffusion Model - Namelist Inputs (Continued)



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PROBLEM NO

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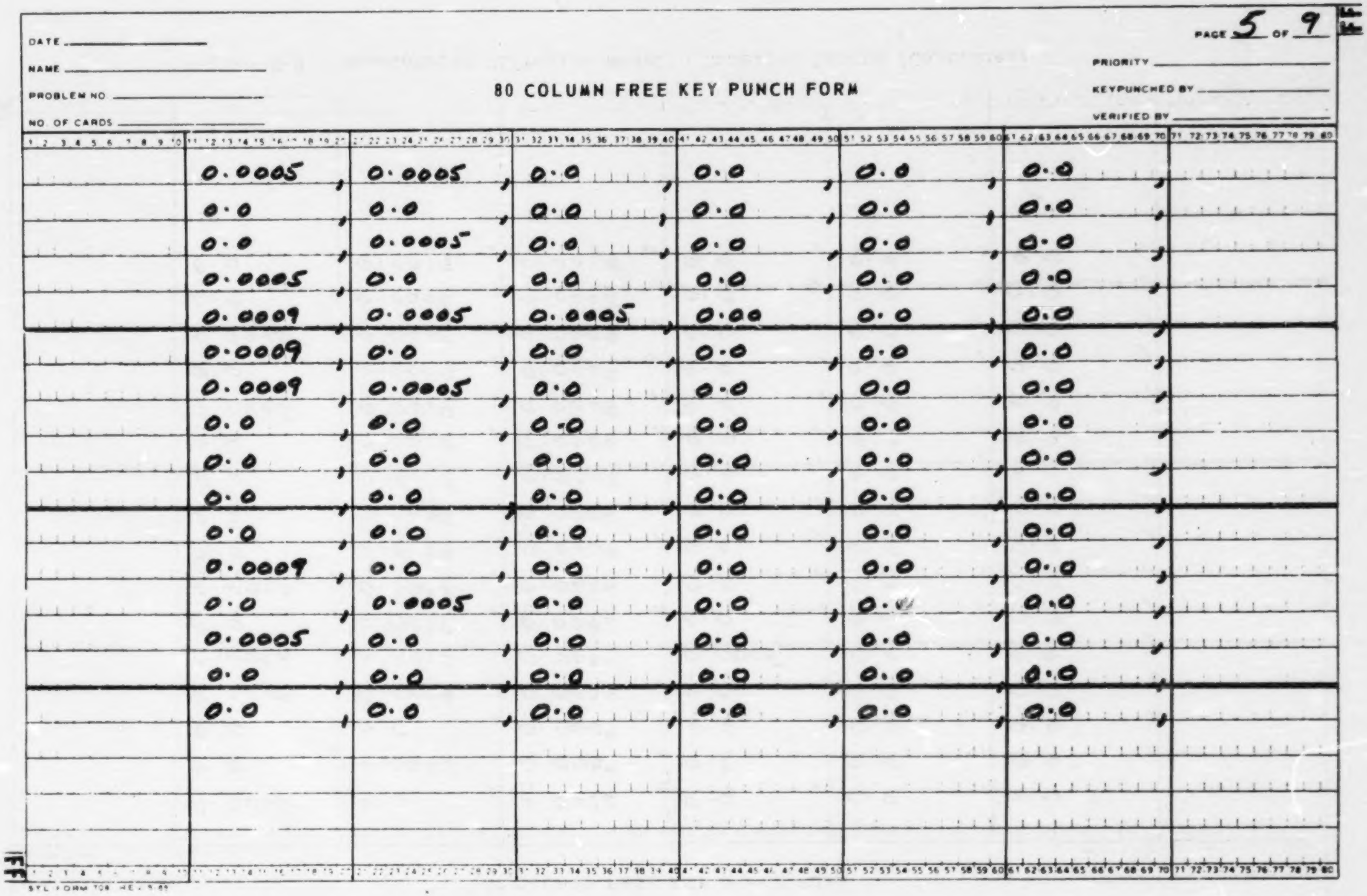
```
          0.0      ,0.0      ,0.0      ,0.0      ,0.0      ,0.0      ,
          0.0      ,0.0      ,0.0      ,0.0      ,0.0      ,0.0      ,
          0.0      ,0.0      ,0.0      ,0.0      ,0.0      ,0.0      ,
          0.0      ,0.0      ,0.0      ,0.0      ,0.0      ,0.0      ,
          0.0      ,0.0      ,0.0      ,0.0      ,0.0      ,0.0      ,
          0.0      ,0.0      ,0.0      ,0.0      ,0.0      ,0.0      ,
          0.0      ,0.0      ,0.0      ,0.0      ,0.0      ,0.0      ,
          0.0      ,0.0      ,0.0      ,0.0      ,0.0      ,0.0      ,
          0.0      ,0.0      ,0.0      ,0.0      ,0.0      ,0.0      ,
          0.0      ,0.0      ,0.0      ,0.0      ,0.0      ,0.0      ,
          0.0      ,0.0      ,0.0      ,0.0      ,0.0      ,0.0      ,
          0.0      ,0.0      ,0.0      ,0.0      ,0.0      ,0.0      ,
          0.0      ,0.0      ,0.0      ,0.0      ,0.0      ,0.0      ,
          0.0      ,0.0      ,0.0      ,0.0      ,0.0      ,0.0      ,
          0.0      ,0.0      ,0.0      ,0.0      ,0.0      ,0.0      ,
          0.0      ,0.0      ,0.0      ,0.0      ,0.0      ,0.0      ,
```

Figure 8-8. Atmospheric Diffusion Model - Namelist Inputs (Continued)



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DATE
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1–10	11–20	21–30	31–40	41–50	51–60	61–70	71–80
	0.0005 ,	0.0005 ,	0.0 ,	0.0 ,	0.0 ,	0.0 ,	
	0.0 ,	0.0 ,	0.0 ,	0.0 ,	0.0 ,	0.0 ,	
	0.0 ,	0.0005 ,	0.0 ,	0.0 ,	0.0 ,	0.0 ,	
	0.0005 ,	0.0 ,	0.0 ,	0.0 ,	0.0 ,	0.0 ,	
	0.0009 ,	0.0005 ,	0.0005 ,	0.00 ,	0.0 ,	0.0 ,	
	0.0009 ,	0.0 ,	0.0 ,	0.0 ,	0.0 ,	0.0 ,	
	0.0009 ,	0.0005 ,	0.0 ,	0.0 ,	0.0 ,	0.0 ,	
	0.0 ,	0.0 ,	0.0 ,	0.0 ,	0.0 ,	0.0 ,	
	0.0 ,	0.0 ,	0.0 ,	0.0 ,	0.0 ,	0.0 ,	
	0.0 ,	0.0 ,	0.0 ,	0.0 ,	0.0 ,	0.0 ,	
	0.0 ,	0.0 ,	0.0 ,	0.0 ,	0.0 ,	0.0 ,	
	0.0009 ,	0.0 ,	0.0 ,	0.0 ,	0.0 ,	0.0 ,	
	0.0 ,	0.0005 ,	0.0 ,	0.0 ,	0.0 ,	0.0 ,	
	0.0005 ,	0.0 ,	0.0 ,	0.0 ,	0.0 ,	0.0 ,	
	0.0 ,	0.0 ,	0.0 ,	0.0 ,	0.0 ,	0.0 ,	
	0.0 ,	0.0 ,	0.0 ,	0.0 ,	0.0 ,	0.0 ,	

Figure 8-8. Atmospheric Diffusion Model - Namelist Inputs (Continued)

DATE ____________
NAME ____________
PROBLEM NO ____________
NO. OF CARDS ____________

80 COLUMN FREE KEY PUNCH FORM

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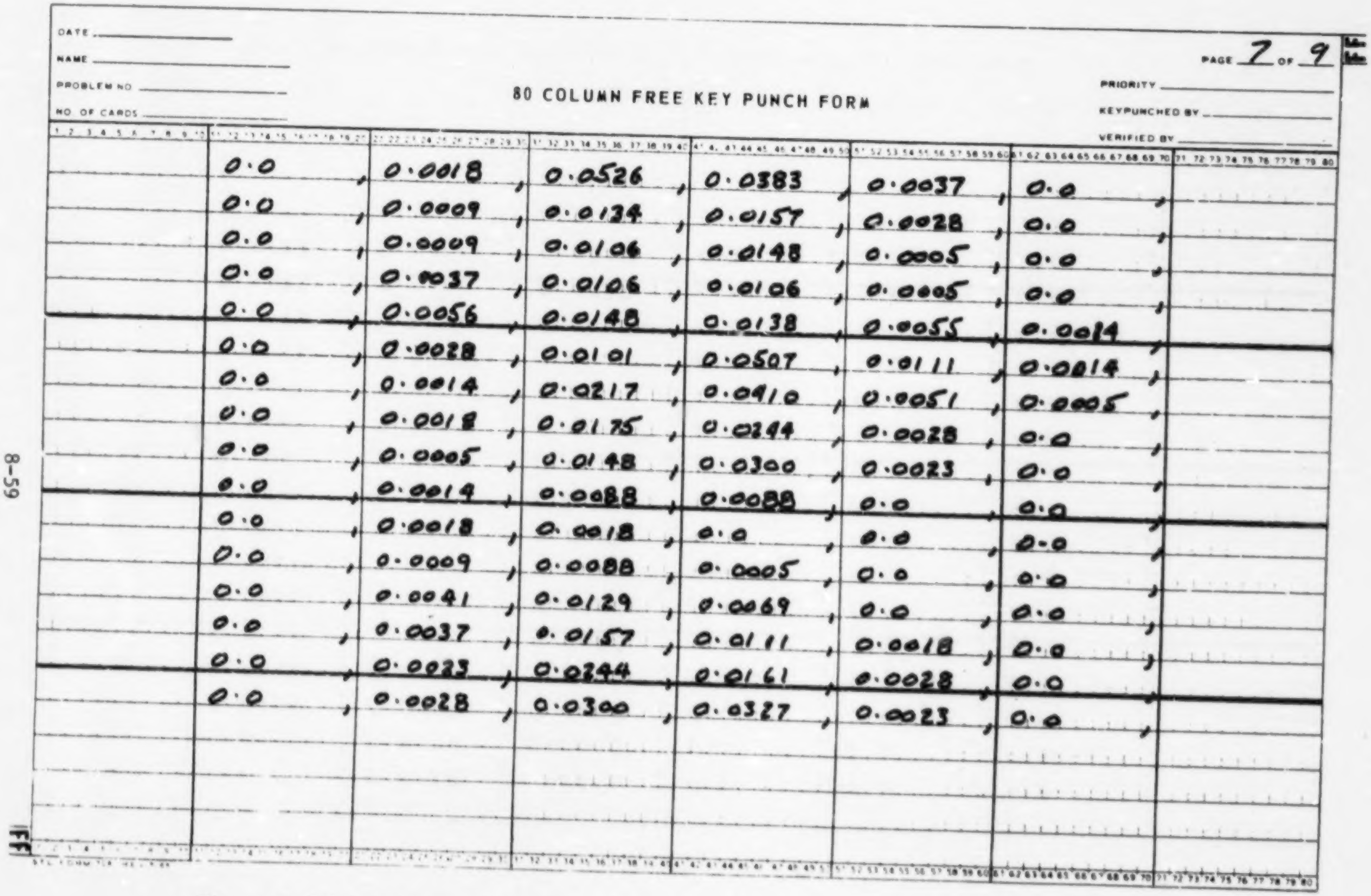
PRIORITY ____________
KEYPUNCHED BY ____________
VERIFIED BY ____________

	0.0005 ,	0.0 ,	0.0032 ,	0.0 ,	0.0 ,	0.0 ,	
	0.0 ,	0.0005 ,	0.0009 ,	0.0 ,	0.0 ,	0.0 ,	
	0.0 ,	0.0 ,	0.0009 ,	0.0 ,	0.0 ,	0.0 ,	
	0.0009 ,	0.0009 ,	0.0096 ,	0.0 ,	0.0 ,	0.0 ,	
	0.0018 ,	0.0028 ,	0.0041 ,	0.0005 ,	0.0 ,	0.0 ,	
	0.0 ,	0.0037 ,	0.0046 ,	0.0 ,	0.0 ,	0.0 ,	
	0.0014 ,	0.0032 ,	0.0028 ,	0.0 ,	0.0 ,	0.0 ,	
	0.0 ,	0.0028 ,	0.0009 ,	0.0 ,	0.0 ,	0.0 ,	
	0.0 ,	0.0009 ,	0.0009 ,	0.0 ,	0.0 ,	0.0 ,	
	0.0 ,	0.0018 ,	0.0009 ,	0.0 ,	0.0 ,	0.0 ,	
	0.0 ,	0.0018 ,	0.0009 ,	0.0 ,	0.0 ,	0.0 ,	
	0.0005 ,	0.0014 ,	0.0009 ,	0.0 ,	0.0 ,	0.0 ,	
	0.0 ,	0.0014 ,	0.0009 ,	0.0 ,	0.0 ,	0.0 ,	
	0.0005 ,	0.0005 ,	0.0009 ,	0.0 ,	0.0 ,	0.0 ,	
	0.0 ,	0.0009 ,	0.0005 ,	0.0 ,	0.0 ,	0.0 ,	
	0.0 ,	0.0019 ,	0.0014 ,	0.0 ,	0.0 ,	0.0 ,	

Figure 8-8. Atmospheric Diffusion Model - Namelist Inputs (Continued)



DATE

NAME

PROBLEM NO

NO. OF CARDS

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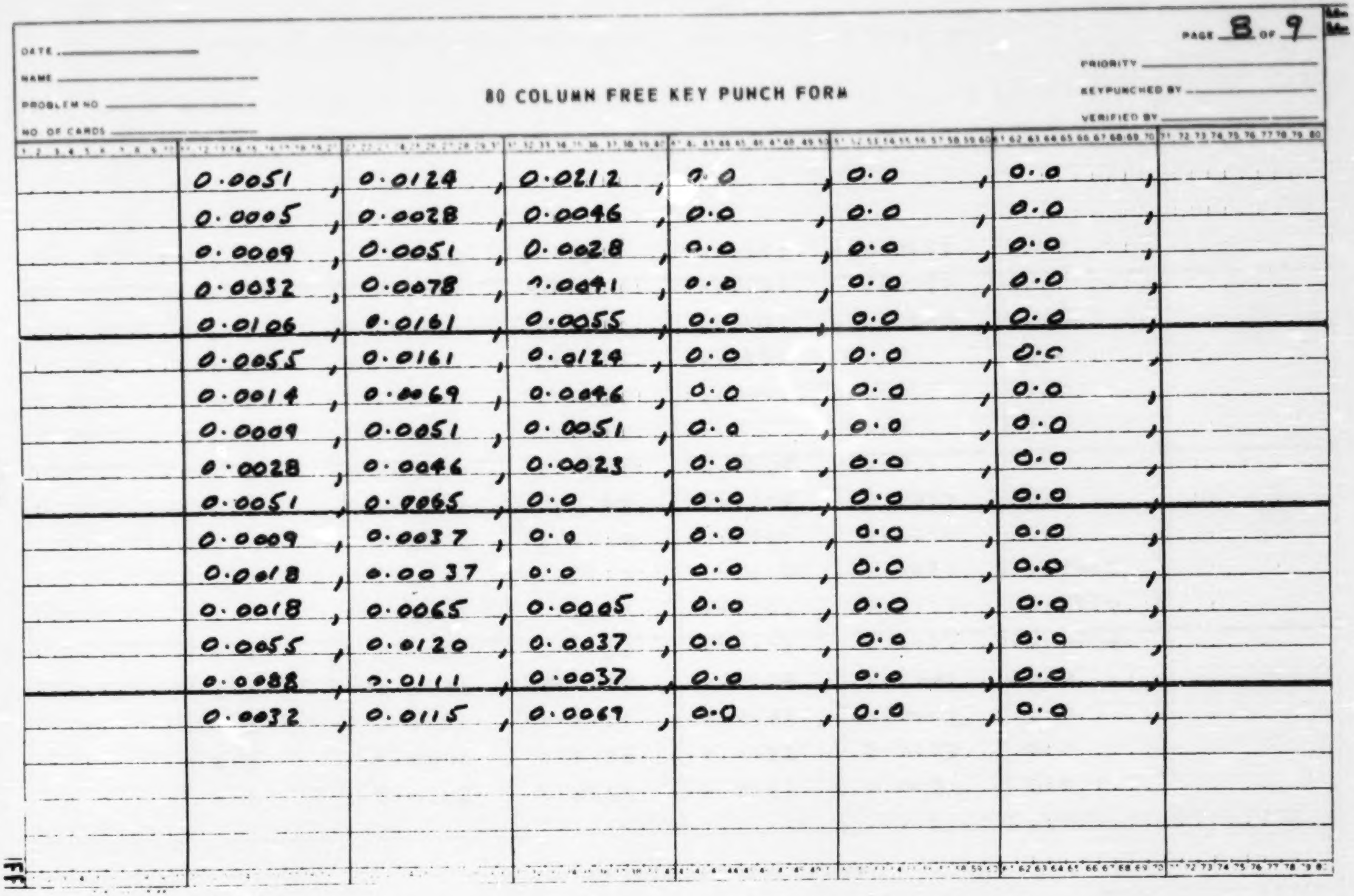
```
          0.0 , 0.0018 , 0.0526 , 0.0383 , 0.0037 , 0.0    ,
          0.0 , 0.0009 , 0.0134 , 0.0157 , 0.0028 , 0.0    ,
          0.0 , 0.0009 , 0.0106 , 0.0148 , 0.0005 , 0.0    ,
          0.0 , 0.0037 , 0.0106 , 0.0106 , 0.0005 , 0.0    ,
          0.0 , 0.0056 , 0.0148 , 0.0138 , 0.0055 , 0.0014 ,
          0.0 , 0.0028 , 0.0101 , 0.0507 , 0.0111 , 0.0014 ,
          0.0 , 0.0014 , 0.0217 , 0.0410 , 0.0051 , 0.0005 ,
          0.0 , 0.0018 , 0.0175 , 0.0344 , 0.0028 , 0.0    ,
          0.0 , 0.0005 , 0.0148 , 0.0300 , 0.0023 , 0.0    ,
          0.0 , 0.0014 , 0.0088 , 0.0088 , 0.0    , 0.0    ,
          0.0 , 0.0018 , 0.0018 , 0.0    , 0.0    , 0.0    ,
          0.0 , 0.0009 , 0.0088 , 0.0005 , 0.0    , 0.0    ,
          0.0 , 0.0041 , 0.0129 , 0.0069 , 0.0    , 0.0    ,
          0.0 , 0.0037 , 0.0157 , 0.0111 , 0.0018 , 0.0    ,
          0.0 , 0.0023 , 0.0344 , 0.0161 , 0.0028 , 0.0    ,
          0.0 , 0.0028 , 0.0300 , 0.0327 , 0.0023 , 0.0    ,
```

Figure 8-8 Atmospheric Diffusion Model - Namelist Input (Continued)



DATE

NAME

PROBLEM NO

NO. OF CARDS

80 COLUMN FREE KEY PUNCH FORM

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PRIORITY

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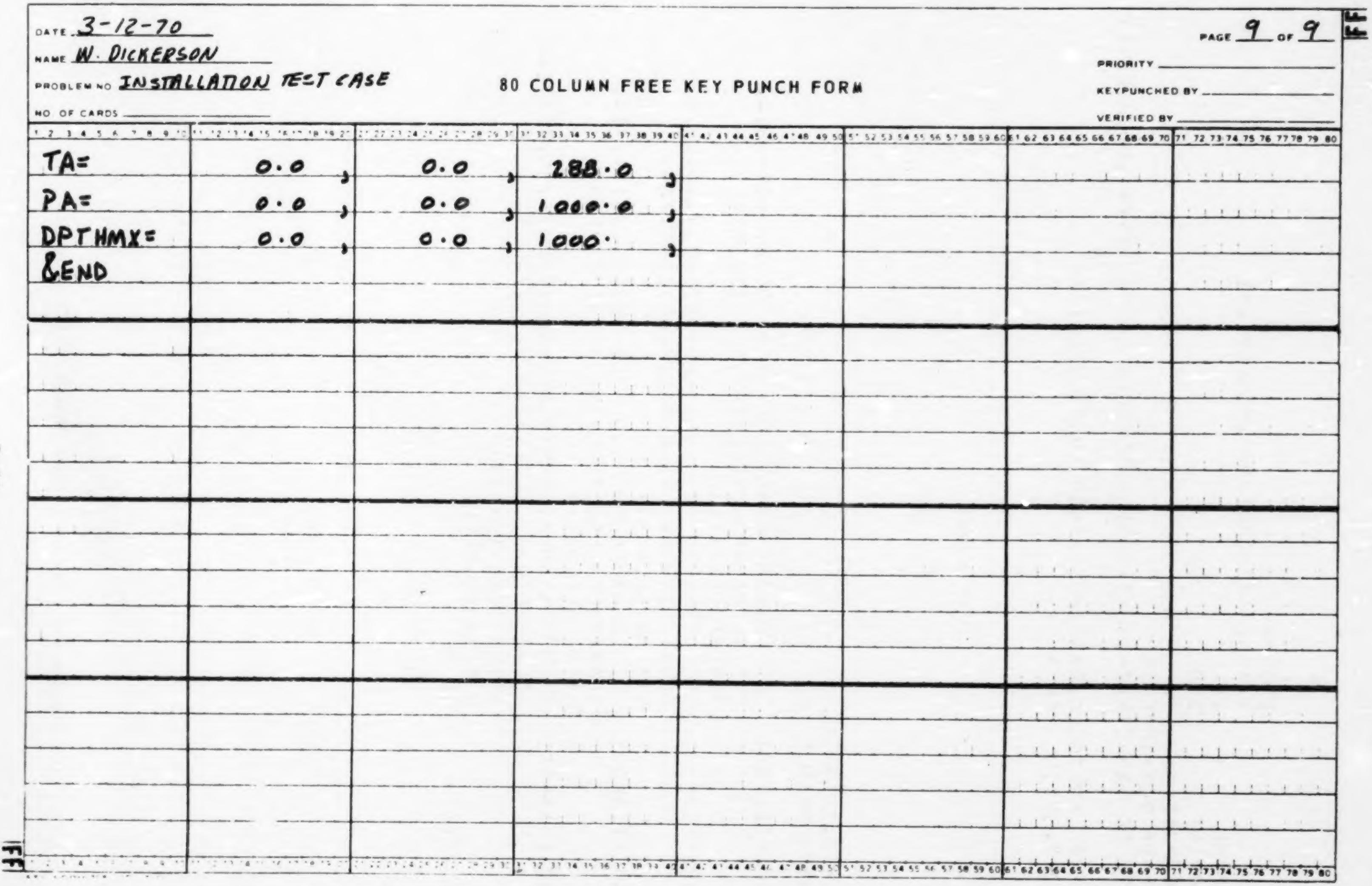
0.0051 ,	0.0124 ,	0.0212 ,	0.0 ,	0.0 ,	0.0 ,	
0.0005 ,	0.0028 ,	0.0046 ,	0.0 ,	0.0 ,	0.0 ,	
0.0009 ,	0.0051 ,	0.0028 ,	0.0 ,	0.0 ,	0.0 ,	
0.0032 ,	0.0078 ,	0.0041 ,	0.0 ,	0.0 ,	0.0 ,	
0.0106 ,	0.0161 ,	0.0055 ,	0.0 ,	0.0 ,	0.0 ,	
0.0055 ,	0.0161 ,	0.0124 ,	0.0 ,	0.0 ,	0.0 ,	
0.0014 ,	0.0069 ,	0.0046 ,	0.0 ,	0.0 ,	0.0 ,	
0.0009 ,	0.0051 ,	0.0051 ,	0.0 ,	0.0 ,	0.0 ,	
0.0028 ,	0.0046 ,	0.0023 ,	0.0 ,	0.0 ,	0.0 ,	
0.0051 ,	0.0065 ,	0.0 ,	0.0 ,	0.0 ,	0.0 ,	
0.0009 ,	0.0037 ,	0.0 ,	0.0 ,	0.0 ,	0.0 ,	
0.0018 ,	0.0037 ,	0.0 ,	0.0 ,	0.0 ,	0.0 ,	
0.0018 ,	0.0065 ,	0.0005 ,	0.0 ,	0.0 ,	0.0 ,	
0.0055 ,	0.0120 ,	0.0037 ,	0.0 ,	0.0 ,	0.0 ,	
0.0088 ,	0.0111 ,	0.0037 ,	0.0 ,	0.0 ,	0.0 ,	
0.0032 ,	0.0115 ,	0.0069 ,	0.0 ,	0.0 ,	0.0 ,	

Figure 8-8 Atmospheric Diffusion Model - Namelist Input (Continued)



DATE 3-12-70

NAME W. DICKERSON

PROBLEM NO INSTALLATION TEST CASE

NO. OF CARDS

80 COLUMN FREE KEY PUNCH FORM

PAGE 9 OF 9

PRIORITY

KEYPUNCHED BY

VERIFIED BY

```
TA=          0.0 ,     0.0 ,   288.0 ,
PA=          0.0 ,     0.0 ,  1000.0 ,
DPTHMX=      0.0 ,     0.0 ,  1000.  ,
&END
```

Figure 8-8 Atmospheric Diffusion Model - Namelist Input (Continued)

```
//             115904,
//             ),'54234839ORDTHMA',MSGLEVEL=1
//*TIME        15
//*PRINT       250
//*COPIES      4
// EXEC PGM=IEFBR14
//DEL DD DSN=STRAT-0,UNIT=2314,VOL=SER=000078,DISP=(OLD,DELETE)

// EXEC FORTGCLG,PARM.FORT='MAP,NOLIST,NODECK'
//FORT.SYSIN   DD *
```

•
•

Source Deck

•
•
•

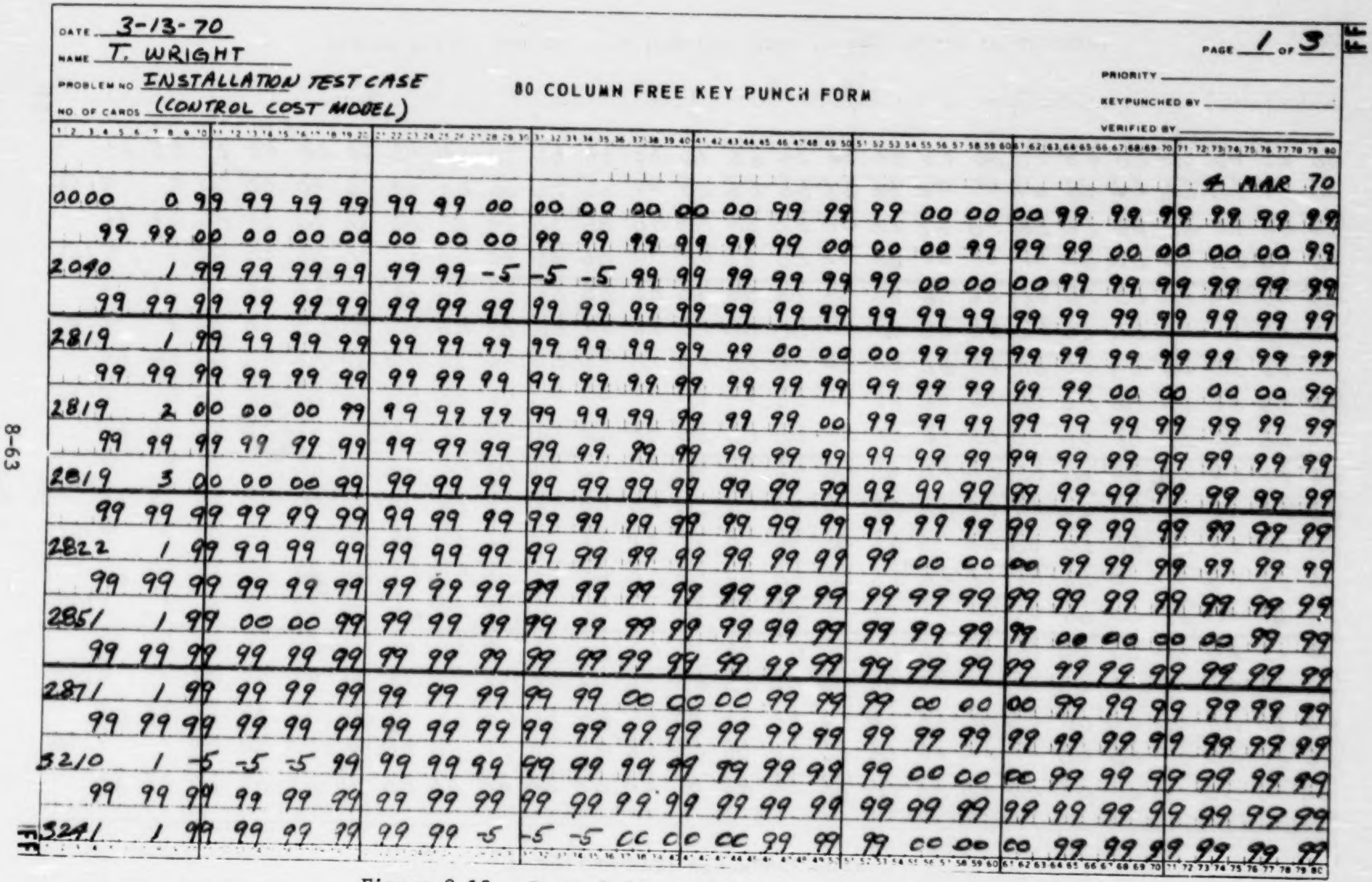
```
//LKED.SYSIN DD *
 ENTRY MAIN

//GO.FT11F001   DD  DSNAME=R-907,VOL=SER=000078,UNIT=2314,
//             DCB=(RECFM=FB,LRECL=546,BLKSIZE=3276),
//             DISP=(OLD,PASS)
//GO.FT12F001   DD  DSNAME=S-907,VOL=SER=000078,UNIT=2314,
//             DCB=(RECFM=FB,LRECL=962,BLKSIZE=5772),
//             DISP=(OLD,PASS)
//GO.FT13F001   DD  DSNAME=D-907,VOL=SER=000078,UNIT=2314,
//             DCB=(RECFM=FB,LRECL=468,BLKSIZE=2808),
//             DISP=(OLD,PASS)
//GO.FT14F001     DD DSNAME=STRAT-0,VOL=SER=000078,UNIT=2314,
//             DCB=(RECFM=FB,LRECL=300,BLKSIZE=0300),
//             SPACE=(CYL,(1,1)),
//             DISP=(NEW,KEEP)
//GO.SYSIN     DD *
```

•
•

Fixed Format
Input Deck

•
•

Figure 8-9. Control Cost Model - JCL Inputs



DATE 3-13-70
NAME T. WRIGHT
PROBLEM NO INSTALLATION TEST CASE
NO. OF CARDS (CONTROL COST MODEL)

80 COLUMN FREE KEY PUNCH FORM

PAGE 1 OF 3
PRIORITY
KEYPUNCHED BY
VERIFIED BY

```
                                                                       4 MAR 70
00.00  0 99 99 99 99 99 99 00 00 00 00 00 00 99 99 99 00 00 00 99 99 99 99 99 99
   99 99 00 00 00 00 00 00 00 99 99 99 99 99 99 00 00 00 99 99 99 00 00 00 00 99
2040   1 99 99 99 99 99 99 -5 -5 -5 99 99 99 99 99 99 00 00 00 99 99 99 99 99 99
   99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99
2819   1 99 99 99 99 99 99 99 99 99 99 99 99 00 00 00 99 99 99 99 99 99 99 99 99
   99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 00 00 00 00 99
2819   2 00 00 00 99 99 99 99 99 99 99 99 99 99 00 99 99 99 99 99 99 99 99 99 99
   99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99
2819   3 00 00 00 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99
   99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99
2822   1 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 00 00 00 99 99 99 99 99 99
   99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99
2851   1 99 00 00 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 00 00 00 00 99 99
   99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99
2871   1 99 99 99 99 99 99 99 99 99 00 00 00 99 99 99 00 00 00 99 99 99 99 99 99
   99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99
3210   1 -5 -5 -5 99 99 99 99 99 99 99 99 99 99 99 99 00 00 00 99 99 99 99 99 99
   99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99
3241   1 99 99 99 99 99 99 -5 -5 -5 00 00 00 99 99 99 00 00 00 99 99 99 99 99 99
```

Figure 8-10. Control Cost Model - Fixed Format Inputs

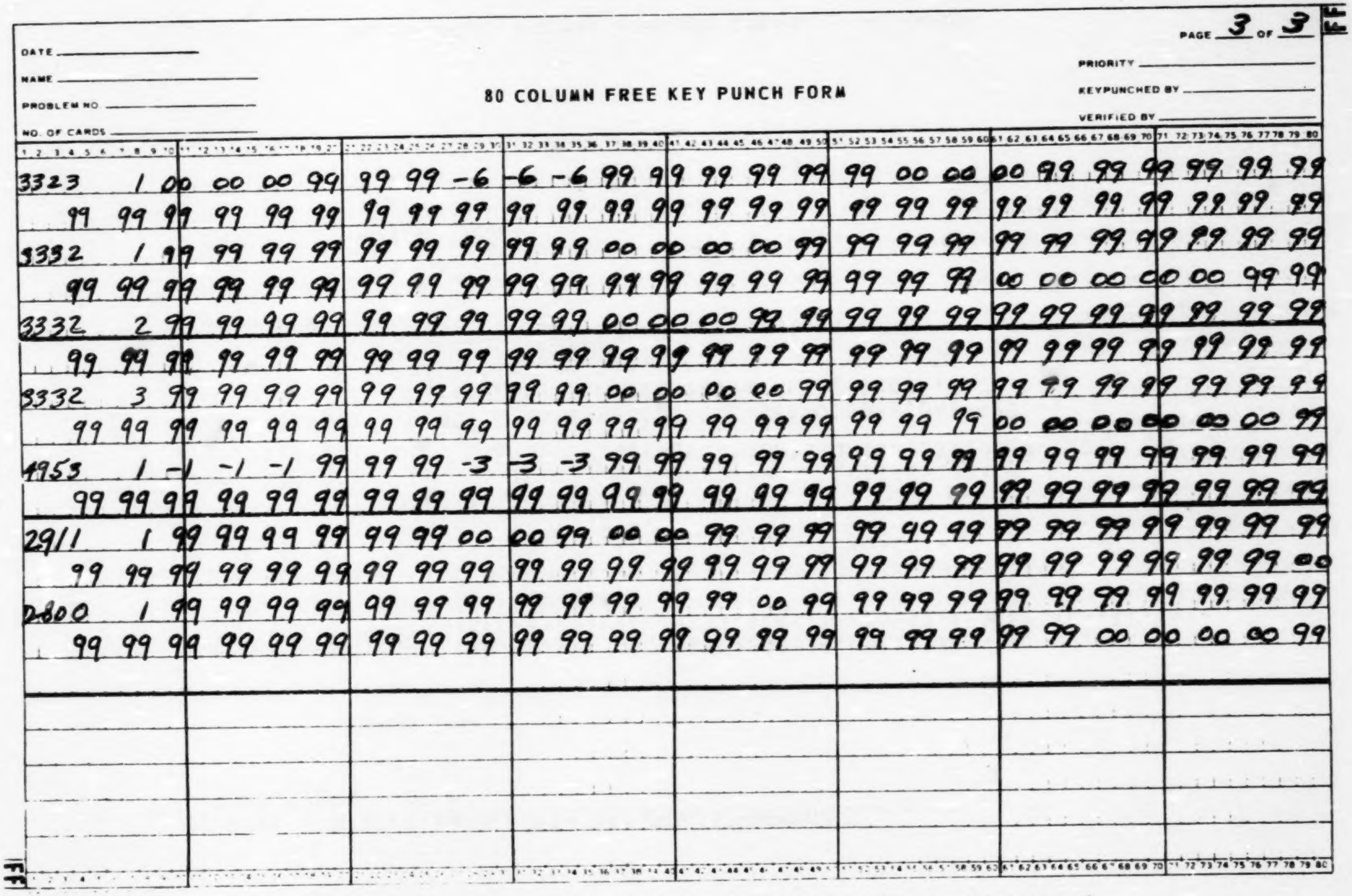
DATE ____
NAME ____
PROBLEM NO ____
NO OF CARDS ____

80 COLUMN FREE KEY PUNCH FORM

PAGE 2 OF 3
PRIORITY ____
KEYPUNCHED BY ____
VERIFIED BY ____

1 2 3 4 5 6 7 8 9 10	11 12 13 14 15 16 17 18 19 20	21 22 23 24 25 26 27 28 29 30	31 32 33 34 35 36 37 38 39 40	41 42 43 44 45 46 47 48 49 50	51 52 53 54 55 56 57 58 59 60	61 62 63 64 65 66 67 68 69 70	71 72 73 74 75 76 77 78 79 80
99 99 9	9 99 99 99	99 99 99	99 99 99 9	9 99 99 99	99 99 99	99 99 99 9	9 99 99 99
2951 1 0	0 00 00 99	99 99 00	00 00 99 9	9 99 99 99	99 00 00	00 99 99 9	9 99 99 99
99 99 9	9 99 99 99	99 99 99	99 99 99 9	9 99 99 99	99 99 99	99 99 99 9	9 99 99 99
3250 1 0	0 00 00 99	99 99 00	00 00 99 9	9 99 99 99	99 00 00	00 99 99 9	9 99 99 99
99 99 9	9 99 99 99	99 99 99	99 99 99 9	9 99 99 99	99 99 99	99 99 99 9	9 99 99 99
3295 1 .	2 00 00 99	99 99 00	00 00 99 9	9 99 99 99	99 00 00	00 99 99 9	9 99 99 99
99 99 9	9 99 99 99	99 99 99	99 99 99 9	9 99 99 99	99 99 99	99 99 99 9	9 99 99 99
3312 1 0	0 99 99 99	99 99 99	99 99 00 0	0 99 99 99	99 99 99	99 99 99 9	9 99 99 99
99 99 9	9 99 99 99	99 99 99	99 99 99 9	9 99 99 99	99 99 99	99 99 99 9	9 99 99 99
3312 2 0	0 99 99 99	99 99 99	99 99 00 0	0 99 99 99	99 99 99	99 99 99 9	9 99 99 99
99 99 9	9 99 99 99	99 99 99	99 99 99 9	9 99 99 99	99 99 99	99 99 99 9	9 99 99 99
3312 3 9	9 99 99 99	99 99 00	00 00 -3 -	3 -3 99 99	99 99 99	99 99 99 9	9 99 99 99
99 99 9	9 99 99 99	99 99 99	99 99 99 9	9 99 99 99	99 99 99	99 99 99 9	9 99 99 99
3312 4 9	9 99 99 99	99 99 99	99 99 99 9	9 99 99 99	99 99 99	99 99 99 9	9 99 99 99
99 99 9	9 99 99 99	99 99 99	99 99 99 9	9 99 99 99	99 99 99	99 99 99 9	9 99 99 99
3312 5 0	0 99 99 99	99 99 99	99 99 00 0	0 99 99 99	99 00 00	00 99 99 9	9 99 99 99
99 99 9	9 99 99 99	99 99 99	99 99 99 9	9 99 99 99	99 99 99	99 99 99 9	9 99 99 99
3312 6 0	0 99 99 99	99 99 99	99 99 00 9	9 99 99 99	99 00 00	00 99 99 9	9 99 99 99
99 99 9	9 99 99 99	99 99 99	99 99 99 9	9 99 99 99	99 99 99	99 99 99 9	9 99 99 99

Figure 8-10. Control Cost Model - Fixed Format Inputs (Continued)



PAGE 3 OF 3

DATE

NAME

PROBLEM NO

NO. OF CARDS

80 COLUMN FREE KEY PUNCH FORM

PRIORITY

KEYPUNCHED BY

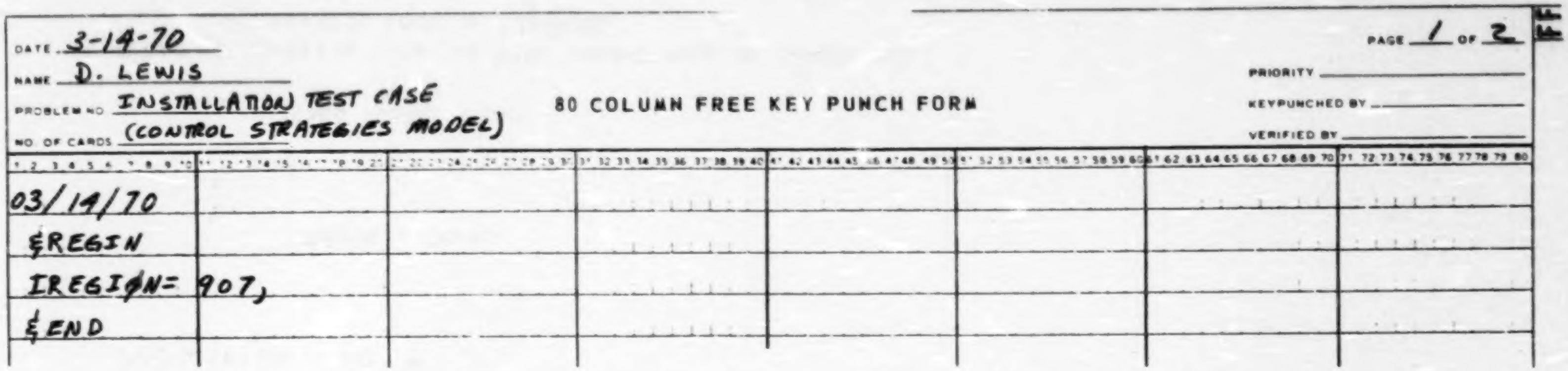
VERIFIED BY

```
3323    1 00 00 00 99 99 99 -6 -6 -6 99 99 99 99 99 99 00 00 00 99 99 99 99 99 99
   99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99
3332    1 99 99 99 99 99 99 99 99 99 00 00 00 00 99 99 99 99 99 99 99 99 99 99 99
   99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 00 00 00 00 00 99 99
3332    2 99 99 99 99 99 99 99 99 99 00 00 00 99 99 99 99 99 99 99 99 99 99 99 99
   99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99
3332    3 99 99 99 99 99 99 99 99 99 00 00 00 00 99 99 99 99 99 99 99 99 99 99 99
   99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 00 00 00 00 00 00 99
4953    1 -1 -1 -1 99 99 99 -3 -3 -3 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99
   99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99
2911    1 99 99 99 99 99 99 00 00 99 00 00 99 99 99 99 99 99 99 99 99 99 99 99 99
   99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 00
2800    1 99 99 99 99 99 99 99 99 99 99 99 99 00 99 99 99 99 99 99 99 99 99 99 99
   99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 00 00 00 00 99
```

Figure 8-10. Control Cost Model - Fixed Format Inputs (Continued)

```
// EXEC FORTGCLG,PARM.FORT='MAP,NOLIST,NODECK'
//FORT.SYSIN   DD *
                •
          Source Deck
                •
//GO.FT08F001  DD  DSN=&ERRMSG,VOL=SER=000078,UNIT=2314,
//             DCB=(RECFM=FB,LRECL=133,BLKSIZE=2660),SPACE=(TRK,(1,1)),
//             DISP=(NEW,PASS)
//GO.FT09F001     DD DSNAME=STRAT-0,VOL=SER=000078,UNIT=2314,
//             DCB=(RECFM=FB,LRECL=300,BLKSIZE=0300),
//             SPACE=(CYL,(1,1)),
//             DISP=(OLD,KEEP)
//GO.FT10F001   DD   SYSOUT=A,DCB=(RECFM=UA,BLKSIZE=133)
//GO.FT11F001  DD   DSN=S-907,VOL=SER=000078,UNIT=2314,DISP=OLD
//GO.FT20F001     DD  DSNAME=REG007,VOL=SER=000078,UNIT=2314,
//             DCB=(RECFM=FB,LRECL=300,BLKSIZE=0300),
//             SPACE=(CYL,(1,1)),
//             DISP=(OLD,KEEP)
//GO.SYSIN    DD  *
                •
                •
          Namelist Input
                •
                •
```

Figure 8-11. Control Standards Segment - JCL Inputs



DATE 3-14-70

NAME D. LEWIS

PROBLEM NO. INSTALLATION TEST CASE

NO. OF CARDS (CONTROL STRATEGIES MODEL)

80 COLUMN FREE KEY PUNCH FORM

PAGE 1 OF 2

PRIORITY

KEYPUNCHED BY

VERIFIED BY

```
03/14/70
 &REGIN
 IREGION= 907,
 &END
```

Figure 8-12. Control Standards Segment - Namelist Input

```
// EXEC FORTGCLG,PARM.FORT='MAP,NOLIST,NODECK'
//FORT.SYSIN   DD *
```

•
•

Source Deck

•
•
•

```
//GO.FT08F001  DD  DSN=PROJ-7,UNIT=2314,VOL=SER=000078,DISP=(OLD,KEEP)
//GO.FT09F001  DD  DSN=UREG007,VOL=SER=000078,UNIT=2314,DISP=(OLD,KEEP)
//GO.FT10F001  DD  DSN=KAY,UNIT=2400,DISP=OLD,LABEL=(,NL,,IN),
//               VOL=SER=000325,DCB=(RECFM=VS,LRECL=192,BLKSIZE=196)
//GO.FT11F001  DD   DSN=S-907,VOL=SER=000078,UNIT=2314,DISP=OLD
//GO.FT12F001  DD  DSN=REGSVE,VOL=SER=000078,UNIT=2314,DISP=(NEW,PASS),
//               DCB=(RECFM=VSB,LRECL=52,BLKSIZE=600),SPACE=(TRK,(2,1))
//GO.SYSIN   DD  *
```

•
•

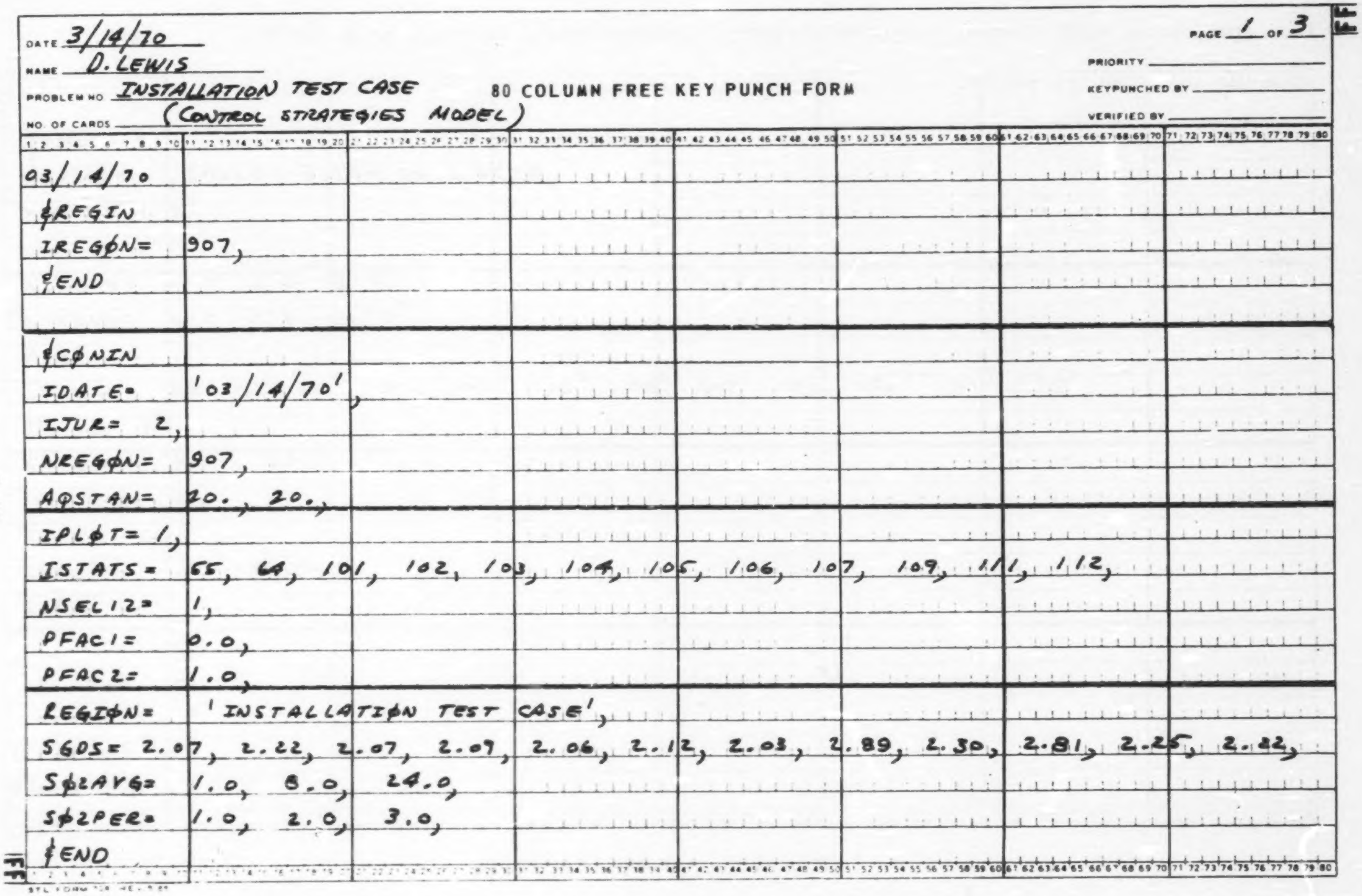
Namelist Input

•
•

Fixed Format Input

Note: Projection data for file PRØJ-7 must be loaded via IBM utility routine IEBGENER.

Figure 8-13. Strategy Output Segment - JCL Inputs



DATE 3/14/70

NAME D. LEWIS

PROBLEM NO. INSTALLATION TEST CASE (CONTROL STRATEGIES MODEL)

NO. OF CARDS

80 COLUMN FREE KEY PUNCH FORM

PAGE 1 OF 3

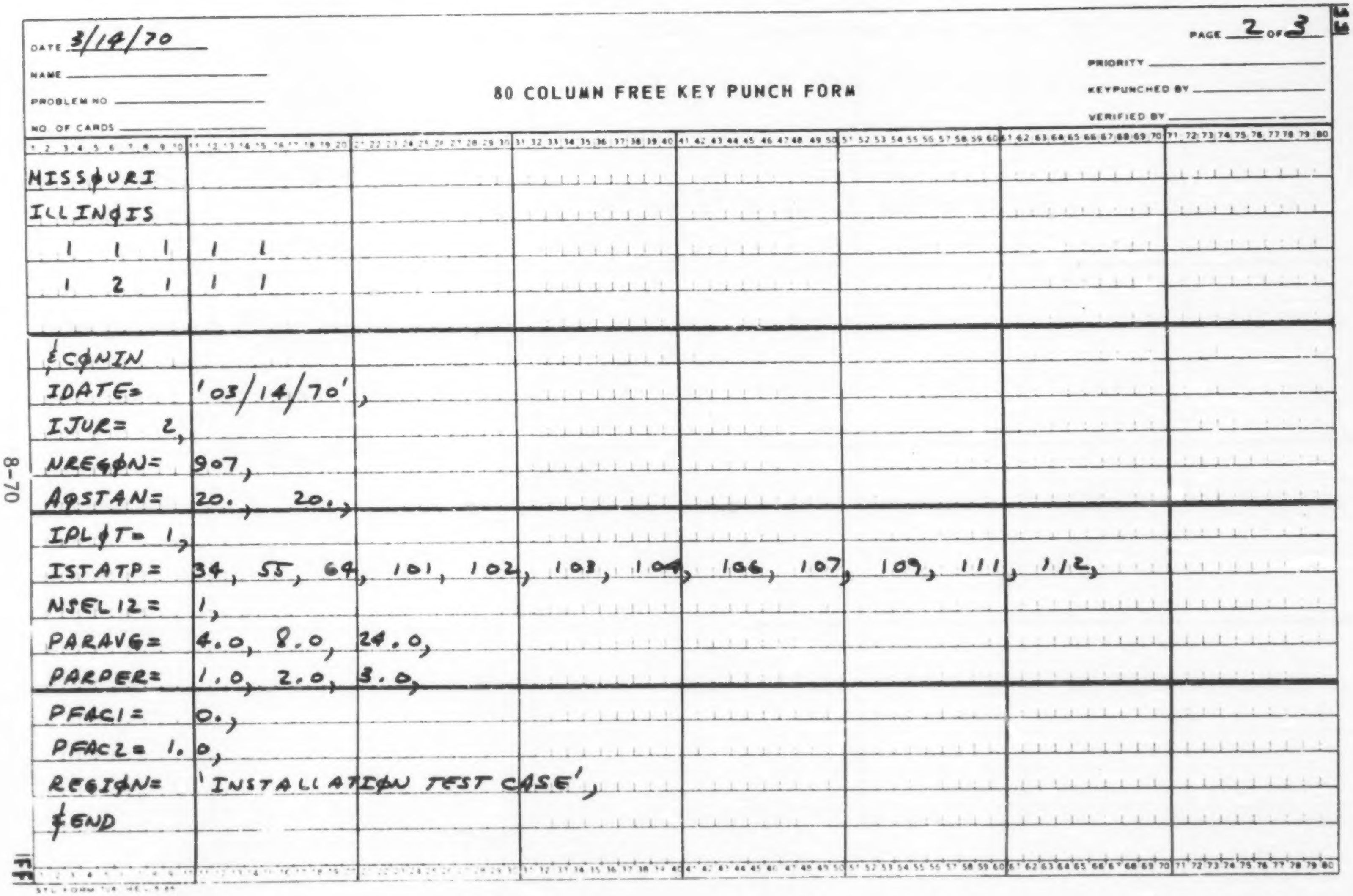
PRIORITY

KEYPUNCHED BY

VERIFIED BY

```
03/14/70
$REGIN
IREGØN= 907,
$END

$CØNIN
IDATE= '03/14/70',
IJUR= 2,
NREGØN= 907,
AØSTAN= 20., 20.,
IPLØT= 1,
ISTATS= 65, 68, 101, 102, 103, 104, 105, 106, 107, 109, 111, 112,
NSELI2= 1,
PFAC1= 0.0,
PFAC2= 1.0,
REGIØN= 'INSTALLATIØN TEST CASE',
SGDS= 2.07, 2.22, 2.07, 2.09, 2.06, 2.12, 2.03, 2.89, 2.30, 2.81, 2.25, 2.22,
SØ2AVG= 1.0, 8.0, 24.0,
SØ2PER= 1.0, 2.0, 3.0,
$END
```

Figure 8-14. Strategy Output Segment - Namelist and Fixed Format Inputs


DATE 3/14/70

NAME

PROBLEM NO

NO. OF CARDS

80 COLUMN FREE KEY PUNCH FORM

PAGE 2 OF 3

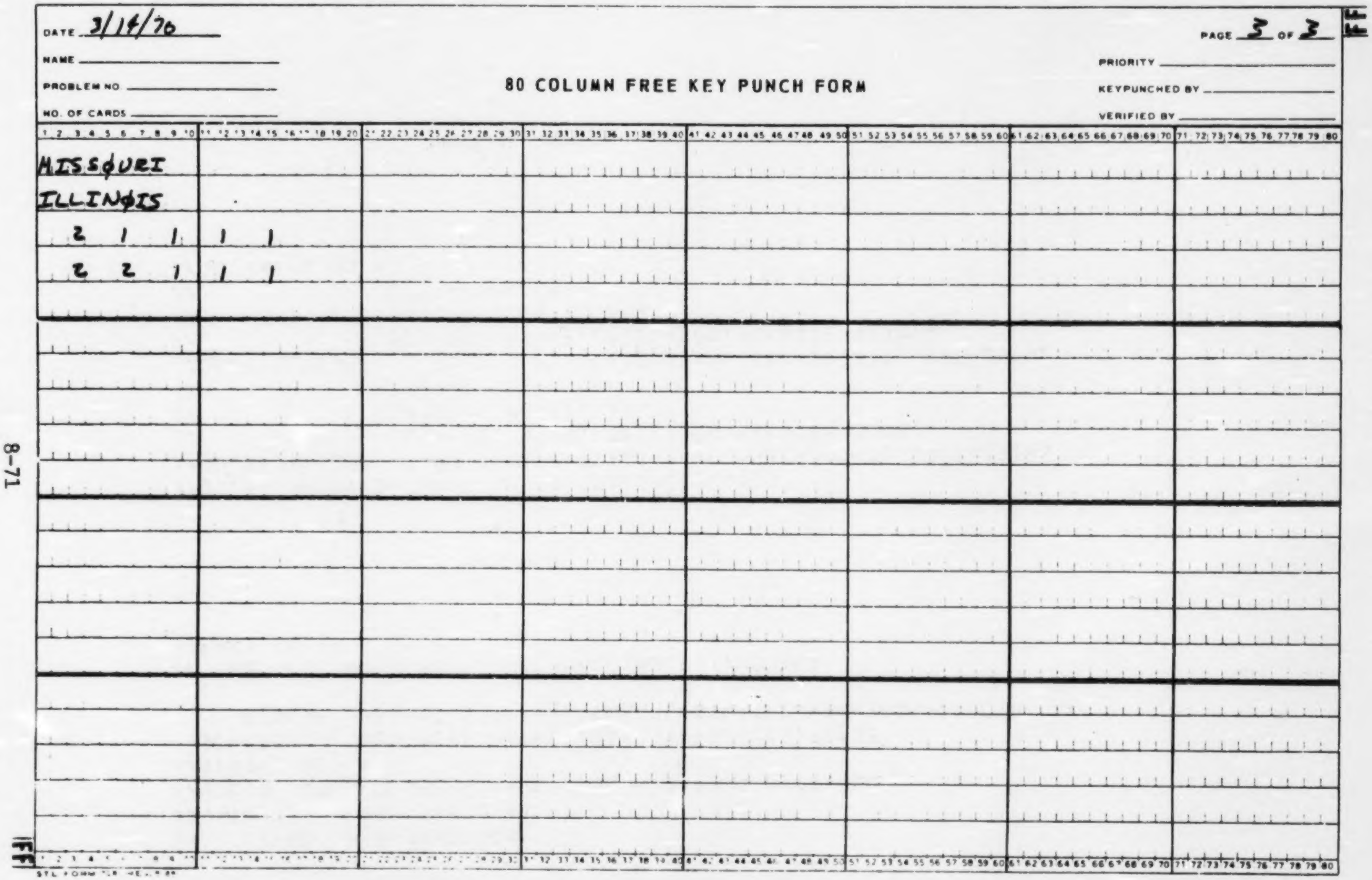
PRIORITY

KEYPUNCHED BY

VERIFIED BY

```
MISSOURI
ILLINOIS
 1  1  1  1  1
 1  2  1  1  1

$CONIN
 IDATE=   '03/14/70',
 IJUR=  2,
 NREGON=  907,
 AOSTAN=  20.,   20.,
 IPLOT= 1,
 ISTATP=  34, 55, 64, 101, 102, 103, 104, 106, 107, 109, 111, 112,
 NSEL12=  1,
 PARAVG=  4.0, 8.0, 24.0,
 PARPER=  1.0, 2.0, 3.0,
 PFAC1=   0.,
 PFAC2= 1.0,
 REGION=  'INSTALLATION TEST CASE',
$END
```

Figure 8-14. Strategy Output Segment - Namelist and Fixed Format Inputs (Continued)



DATE 3/14/70

NAME

PROBLEM NO.

NO. OF CARDS

80 COLUMN FREE KEY PUNCH FORM

PAGE 3 OF 3

PRIORITY

KEYPUNCHED BY

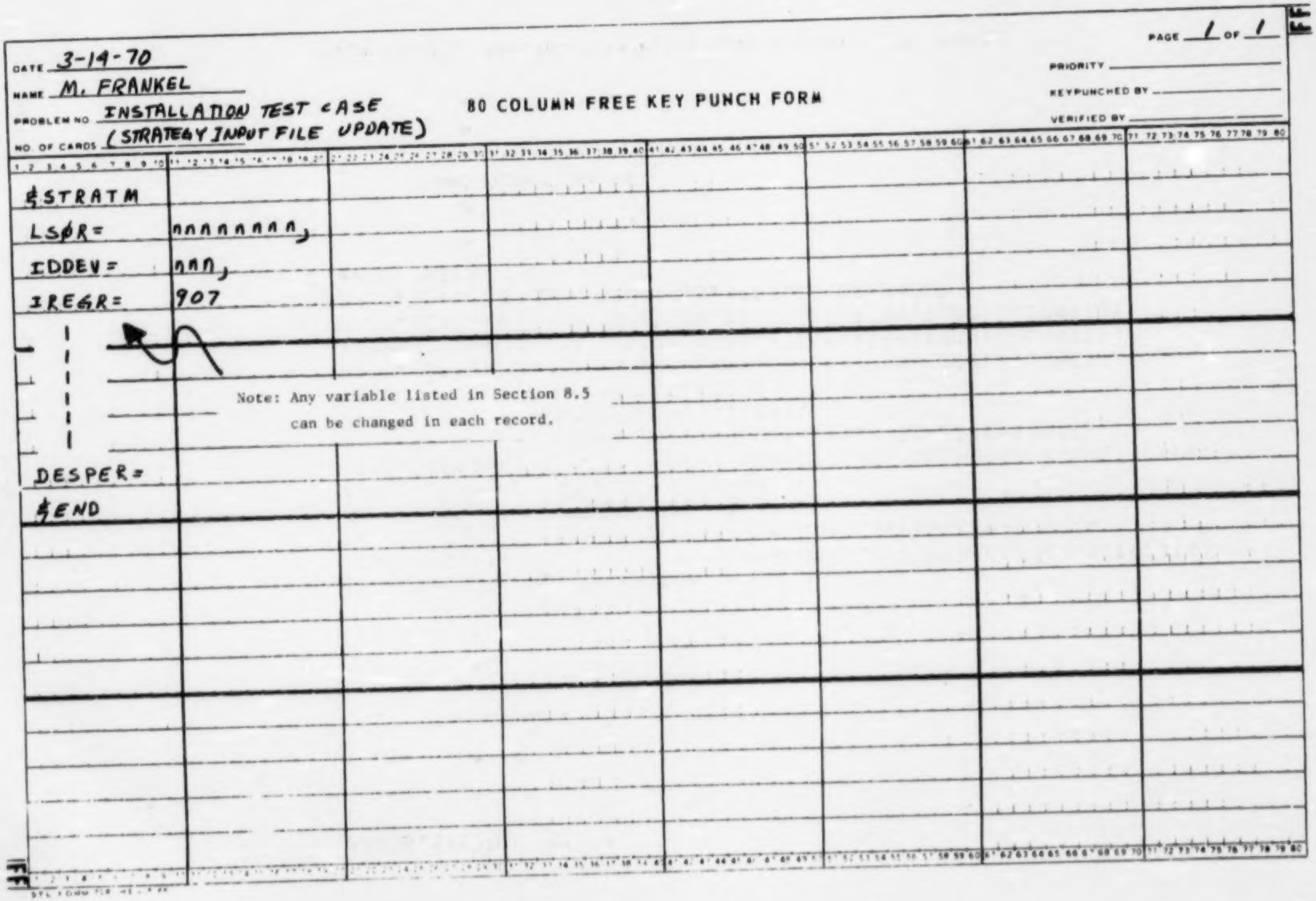
VERIFIED BY

```
MISSOURI
ILLINOIS
  2  1  1  1  1
  2  2  1  1  1
```

Figure 8-14. Strategy Output Segment - Namelist and Fixed Format Inputs (Continued)

```
//    EXEC  PGM=IEHPROGM
//SYSPRINT   DD  SYSOUT=A
//VOL78  DD  VOLUME=SER=CC0078,UNIT=2314,DISP=OLD
//SYSIN  DD  *
  SCRATCH    DSNAME=STRAT-P,VOL=2314=000078,PURGE
     RENAME  DSNAME=STRAT-O,NEWNAME=STRAT-P,VOL=2314=000078

// EXEC FORTGCLG,PARM.FORT='MAP,NOLIST,NODECK'
//FORT.SYSIN   DD *
                              .
                              .

                          Source Deck

                              .
                              .
//GO.FT12F001 DD UNIT=SYSDA,SPACE=(CYL,005)
//GO.FT13F001      DD DSNAME=STRAT-P,VOL=SER=000078,UNIT=2314,
//              DCB=(RECFM=FB,LRECL=300,BLKSIZE=0300),
//              SPACE=(CYL,(1,1)),
//              DISP=(OLD,PASS)
//GO.FT14F001      DD DSNAME=STRAT-O,VOL=SER=000078,UNIT=2314,
//              DCB=(RECFM=FB,LRECL=300,BLKSIZE=0300),
//              SPACE=(CYL,(1,1)),
//              DISP=(NEW,KEEP)
//GO.SYSIN DD *

                              .
                              .

                        Namelist Inputs

                              .
                              .
```

Figure 8-15. Strategy Input File Update - JCL Inputs



80 COLUMN FREE KEY PUNCH FORM

DATE 3-14-70
NAME M. FRANKEL
PROBLEM NO. INSTALLATION TEST CASE
NO. OF CARDS (STRATEGY INPUT FILE UPDATE)

PAGE 1 OF 1
PRIORITY
KEYPUNCHED BY
VERIFIED BY

```
$STRATM
LSØR=     nnnnnnnnn,
IDDEV=    nnn,
IREGR=    907
   |
   |
   |
   |
DESPER=
$END
```

Note: Any variable listed in Section 8.5
can be changed in each record.

Figure 8-16. Strategy Input File Update - Namelist Inputs

```
//COB.SYSIN   DD  *
```

•
•

Source Deck

•
•

```
//GO.SYSOUT  DD  SYSOUT=A
//GO.REGDATA       DD  DSNAME=REG007,VOL=SER=000078,UNIT=2314,
//                DCB=(RECFM=FB,LRECL=300,BLKSIZE=0300),
//                SPACE=(CYL,(1,1)),
//                DISP=(OLD,KEEP)
//GO.SORTOUT       DD DSNAME=UREG007,VOL=SER=000078,UNIT=2314,
//                DCB=(RECFM=FB,LRECL=300,BLKSIZE=0300),
//                SPACE=(CYL,(1,1)),
//                DISP=(OLD,KEEP)
//GO.SORTWK01  DD  UNIT=SYSDA,SPACE=(TRK,(200),,CONTIG)
//GO.SORTWK02  DD  UNIT=SYSDA,SPACE=(TRK,(200),,CONTIG)
//GO.SORTWK03  DD  UNIT=SYSDA,SPACE=(TRK,(200),,CONTIG)
//GO.SORTLIB  DD  DSN=SYS1.SORTLIB,DISP=OLD
//GO.SYSIN  DD   *
```

•
•

Fixed Format Inputs

•
•

Figure 8-17. Control Strategies Model Update - JCL Inputs

9.0 DESCRIPTION OF OUTPUT

The complete program output from an actual computer run for the Installation Test Case is presented in this chapter. Some of the data in these outputs are the result of computations within the program, while some are simply repeats of the data input by the user. For convenience in analyzing the results of the run, tables of user-supplied data are intermingled with those which result from program calculations. This arrangement also allows reconstruction of the run (i.e., the user will have a record of input data used). Actual tables will generally be longer than those presented, since the hypothetical Test Case has only 52 point and area sources. Numbering of sections and figures is such that descriptive paragraphs will correspond to appropriate illustrative material throughout the chapter (i.e., Section 9.1 will refer to Figure 9-1, 9.2 to 9-2, etc.).

9.1 SOURCE FILE INPUT (Start of Information System)

Figure 9-1 illustrates the actual images of punched cards used to load the disk memory Source File. Each line of print represents one card of input data. The format of this data corresponds to the loadsheets shown in Figure 8-2. Identifying specific sources in these card images requires an inspection of the first ten (10) digits of each card. These contain the region designation (907), followed by the SIC code and the site location number.

The Source File Input list concludes with the statement "END INPUT LIST."

9.2 SOURCE FILE DICTIONARY LISTING

Figure 9-2 illustrates the dictionary used in editing the source file input cards. The field numbers on this list correspond to the source file loadsheets (Figure 8-2). The titles, units of measure, format, and parameter limits correspond to the data specification (Table 7-6).

9.3 SOURCE FILE EDIT ERROR LISTING

Figure 9-3 illustrates the error messages that are printed in the event that input data in some way does not correspond to the dictionary edit listings. A complete description of all error messages is presented in Chapter 7. Each entry in the error list is identified by region, SIC code, and site number designations. In addition, the entries include the field number and parameter value which are in question.

The Edit Summary output is printed at the end of the edit error list. This output provides a tabulation of the number of source file input cards that were rejected and accepted by the editing procedure.

9.4 SOURCE FILE UPDATE AND MAINTENANCE SUMMARY

Figure 9-4 is an example of summary of transactions between the master disk memory file and the edited input records which were inserted, deleted, or changed (overlayed). The last item in this list indicates the total number of records (in this case point and area emission sources) on the master source file.

9.5 SOURCE FILE LISTING

Figure 9-5 illustrates the listing of all records (sources) in the Source File. Each page in this listing represents the file data for one point or area source. The information contained on these pages is self-explanatory.

9.6 DEVICE FILE INPUT

The descriptions of computer outputs in Sections 9.6 through 9.14 for the Device File and Region File correspond to the items discussed in Sections 9.1 through 9.5 for the Source File.

9.7 DEVICE FILE DICTIONARY LISTING

9.8 DEVICE FILE EDIT ERROR LISTING

9.9 DEVICE FILE UPDATE AND MAINTENANCE SUMMARY

9.10 DEVICE FILE LISTING

9.11 REGION FILE INPUT

9.12 REGION FILE DICTIONARY LISTING

9.13 REGION FILE EDIT ERROR LISTING

9.14 REGION FILE UPDATE AND MAINTENANCE SUMMARY

9.15 SOURCE LOCATION DATA (Start of Atmospheric Diffusion Model)

The emission inventory which was prepared as a part of the Source File input in Chapter 8 is itemized in a source data output table (Figure 9-15). Each point and area source in the region is listed on a separate line in this table. Included for each source are the location, area, and, for point sources (indicated by zero area), the physical stack height and stack exit diameter.

9.16 SOURCE EMISSION DATA

The sample emission inventory is continued in Figure 9-16, with the seasonal emission rates, effluent velocity, and exit temperature listed as they were input. As was indicated in Chapter 8, these specific values were used by the Atmospheric Diffusion Model to calculate the effective stack height at which the plume became horizontal.

The calculated value of effective stack height is not shown in the table. However, where values for stack diameter and effluent velocity and temperature were not input, the input height value as listed serves as the estimated effective stack height. The emission rate represents a daily average value for the annual period under consideration.

9.17 METEOROLOGICAL INPUT DATA FOR THE ANNUAL SEASON

Wind roses for the five stability classes which were input on loadsheets as described in Chapter 8 are listed as outputs in Figure 9-17, one wind rose per page. Stability classes 1 through 5 correspond to very unstable, moderately unstable, slightly unstable, neutral, and stable conditions, respectively. For each stability class (i.e., on any given page), the frequency of occurrence of each of the 6 wind speed classes (0-3, 4-6, 7-10, 11-16, 17-21 and over 21 knots) is listed for each of the 16 wind directions. A total of 480 wind frequency values are thus listed. The sum of these frequency values equals unity.

9.18 METEOROLOGICAL INPUT DATA

Figure 9-18 lists additional seasonal meteorological input data for temperature, pressure, mixing depth, and pollutant half-life values. The zero (0.0) values indicate no input data, with a resulting half life of infinity.

9.19 CORRELATION DATA

The air quality data used to calibrate the model is listed in Figure 9-19. A separate table is printed for each pollutant, giving the station number, location, and seasonal arithmetic average concentration at ground level. The two columns within each season present, respectively, the observed (measured) concentration and estimated concentration as computed by the Atmospheric Diffusion Model at each selected monitoring station. Background concentrations which were input are included in the column containing the calculated values. The data in these two columns is used in the computer program to calculate the regression parameters used for the calibrations previously described in Chapter 4. Only the last column in each season group contains values computed by the program. Data in the other columns were input and displayed here to allow comparison of observed and computed concentrations at each location, as in the development of the calibration curves.

9.20 REGRESSION OUTPUT

Figure 9-20 summarizes the results of the calibration of the model for the specific region. Two constants for each pollutant* (Y-intercept and slope) are shown. These constants define the best (least-squares fit) linear equation describing the relationship between calculated and observed concentrations. In addition to the constants, a computed regression coefficient and a 5%-confidence-level regression coefficient are shown. When the value of the computed coefficient is greater than that of the 5% confidence level, calibration is considered to be satisfactory. Each equation is then used by the computer program to adjust the air quality values as dictated by the calibration.

When the computed value of the regression coefficient is less than that corresponding to the 5% confidence level, the following note will be printed in the table: "POOR CORRELATION COEFFICIENTS NOT USED." When this occurs, the air quality values at receptors will be printed without the use of these regression constants. It should also be noted that in this case the constants should not be input using the S02CAL= and PARCAL= cards (Section 8.2). Instead, the reason for the poor correlation should be determined and the necessary corrections made.

---

*Carbon monoxide has been included in this output in anticipation of further program expansions.

9.21 RECEPTOR CONCENTRATION DATA

The primary output of the Atmospheric Diffusion Model is presented in Figure 9-21. Each grid and non-grid receptor is listed on a separate line, by receptor number, together with the location and ground-level concentration for each pollutant as computed by the Model. The term "expected" in the heading over the last three columns is not used in the strict statistical sense, but merely indicates that the values are predictions or estimates made by the Model.

If calibration of the model was requested and was successful (i.e., the calculated regression coefficient exceeded the 5% confidence level), the values printed in this table will have been adjusted using the regression-line parameters.

9.22 POLLUTANT CONCENTRATIONS ABOVE STANDARD

Figure 9-22 lists those receptors at which the ground level concentration exceeds the selected air quality standard (the standards themselves are input variables and are discussed in Section 8.2). This table provides the user with an indication of the relative contributions from point and area sources, thus permitting him to determine whether control of point sources can achieve the levels of the air quality standards. This table is repeated for each pollutant.

9.23 STATISTICAL DATA FOR SELECTED RECEPTORS

A table of statistical data (see Figure 9-23) is printed for each pollutant and averaging-time combination. In each table, statistical data for the specified receptors comprises: the expected arithmetic mean (used here in the sense of predicted or estimated arithmetic mean) from the Model; the standard geometric deviation, which is the input (Section 8.2) value converted to the desired averaging time; and the expected geometric mean and expected maximum concentration values, which are calculated from the expected arithmetic mean and standard geometric deviation values. Again, if calibration of the model was requested and was successful, the arithmetic mean values used in this calculation will have been adjusted using the regression line parameters. In addition, this output lists the expected ground-level concentrations at three percentile values other than the maximum value. These percentile values are selected by an input parameter (see Section 8.2).

This table is repeated for each of the five selected averaging times.

9.24 SOURCE CONTRIBUTIONS TO FIVE SELECTED (MAXIMUM) RECEPTORS

The contributions of each point and area source in the region to the five selected or five maximum receptors (as indicated in the heading) are presented in Figure 9-24. The source numbers correspond to those used in the Source Location Data (Figure 9-15).

The contribution of a given source to each receptor is indicated both as a percentage of the total concentration at the receptor and as an absolute value (micrograms/cubic meter). The contribution of the background concentration, which is constant throughout the region, is shown in the second line from the bottom. The last line contains the total contribution from all sources for each receptor. Since all source contributions and background values are summed, the percentage figure will total 100% and the absolute value will equal the total concentration at each receptor (i.e., the last figure in each receptor column will be the same as that in the Receptor Concentration Data table, Figure 9-21. One table will be presented for each pollutant, and the length of the table will depend on the number of sources in the region.

9.25 CALCOMP ISOPLETHS

The data printed in the Receptor Concentration Data table (Figure 9-21) is also punched on cards for input to a CALCOMP [1967] plotter. The resulting isopleth plot is shown in Figure 9-25. Any desired contour interval of concentration may be selected to display the regional picture of air quality. The Atmospheric Diffusion Model provides only the punched cards; a separate computer program [CALCOMP, 1967] is required to generate the isopleth maps. The CALCOMP system has had wide distribution to computer centers throughout the country, and the user should be able to locate at least one center in his area equipped to prepare the required CALCOMP output.

9.26 SYMAP PLOTS

The same card deck which could be used to generate CALCOMP plots can also be used to make SYMAP [1968] plots (Figure 9-26). This technique requires only the SYMAP program and a line printer, and gives shading in addition to the isopleth contours. If the SYMAP program is not available at a local computer center, the user may obtain the program from the Harvard University Laboratory for Computer Graphics and Spatial Analysis, Cambridge, Massachusetts.

9.27 CONTROL COST-EFFECTIVENESS DATA (Start of Control Cost Model)

The Control Cost Model has one standard output format, shown in Figure 9-27. This format is repeated for each point source identified in the Source File. The Test Case results illustrate the calculated control cost-effectiveness information for 23 point sources within the Test Case region. The number of output tables will generally be greater than those presented in Figure 9-27.

The individual point source is identified by a descriptive name, a Standard Industrial Classification (SIC) code, and a site number. The site number is an arbitrary three-digit code used to identify individual sources within a common SIC code. The fourth digit in the site number is a process type classification within a particular SIC code. A "zero" as the fourth digit represents a combustion source, while a "one" through a "nine" in this position represents an industrial process type (see Section 8.1.1A).

The existing pollutant emission characteristics of the source are described by the number of operating hours per year, the existence of a control device (0 = no device, nnn = Table 5-1 device code), the efficiency of the existing control device, the potential emission rates (tons/day) with no control, and emission rates (tons/day) with existing control devices. The difference between potential and existing emission rates is a measure of the effect of control devices already installed. Where no such device exists, the potential and the existing emission rates are equal.

The body of the table contains the characteristics of control measures applicable to the source. The number of entries in this table depends upon the source type and the number of applicable control measures stored in the control Device File.

The control devices or non-device control measures are described in terms of their code (Table 5-1), brief descriptive name, total annual costs in $000 (broken down into capital costs and operating and maintenance costs), control efficiencies, new controlled emission rates after application of the device, and a dollars per ton effectiveness value for use in evaluating the device.

9.28 REGULATION EFFECTS ON SOURCE EMISSIONS (Start of Control Strategies Model)

The Control Strategies Model provides the user with a capability to observe the effects of a variety of air pollution control strategies. These effects are defined in terms of control costs, control efficiencies, pollutant emission rates, and resulting air quality. Each strategy is composed of source emission standards directed at combustion sources, industrial sources, and solid waste disposal sources. Table 6-1 and, for particulate matter emission standards, Figures 6-1 through 6-8 illustrate the specific characteristics of the emission standards provided with the Installation Test Case. Section 8.4 discusses the input variables needed to define these emission standards or variations of these standards.

The Control Strategies Model output shown in Figure 9-28 illustrates the effects of a sulfur dioxide control strategy. This strategy is composed of two emission standards for the political jurisdiction of Missouri within the Test Case. Since the source emission standard forms the emission restrictions portion of an emission regulation, the results are expressed in terms of sulfur dioxide fuel combustion regulation number 1 and sulfur dioxide industrial process regulation number 1.

The first page of Figure 9-28 illustrates the control devices selected for each of the combustion point sources affected by the Fuel Combustion Regulation. This regulation is described in sulfur dioxide fuel combustion emission standard number 1 (Table 6-1). The control devices selected for each source represent the least experience device which results in a controlled emission rate which conforms to the allowable emission rate specified by this emission standard.

The second page of Figure 9-28 illustrates the control devices selected for each of the industrial point sources affected by the Industrial Process Regulation. This regulation is described in the sulfur dioxide industrial process emission standard number 1 (Table 6-1).

9.29 JURISDICTION SUMMARY

Figure 9-29 summarizes the combined effects of the sulfur dioxide combustion and industrial process regulations in Missouri. In addition, this output provides control cost-effectiveness value in terms of total regional expenditure per ton of sulfur dioxide emission reduction.

9.30 REGULATION EFFECTS ON SOURCE EMISSIONS

Figure 9-30 repeats the description of Figure 9-28 for sulfur dioxide emission standards in the political jurisdiction of Illinois.

9.31 JURISDICTION SUMMARY

Figure 9-31 repeats the description of Figure 9-29 for sulfur dioxide control in the political jurisdiction of Illinois.

9.32 CONTROL STRATEGY EFFECT ON CONCENTRATIONS AT GROUND LEVEL

Figure 9-32 illustrates the air quality results of the sulfur dioxide control regulations. This includes new ground-level concentration, the amount reduced, and the concentration in excess of the air quality standard for each receptor location in the Test Case. The concentration values are all expressed in exponential notation.

9.33 STATISTICAL DATA FOR SELECTED RECEPTORS

Figure 9-33 illustrates the type of statistical data discussed in Section 9.23 for three separate averaging times. These outputs express expected maximum and three selected percentile ground level concentrations resulting from the application of the sulfur dioxide emission standards to the Installation Test Case.

9.34 CONTROL STRATEGY SUMMARY

Figure 9-34 illustrates the first page of final summary of the sulfur dioxide control strategy applied to Missouri and Illinois. The second page of the summary illustrates several regional values which describe the effects of the strategy.

9.35 REGULATION EFFECTS ON SOURCE EMISSIONS

(The discussion on items 9.35 through 9.41 parallels the discussion on items 9-28 through 9-34, the only change being that the control strategy applied is for particulate matter rather than sulfur dioxide).

9.36 JURISDICTION SUMMARY

9.37 REGULATION EFFECTS ON SOURCE EMISSIONS

9.38 JURISDICTION SUMMARY

9.39 CONTROL STRATEGY EFFECTS ON CONCENTRATIONS AT GROUND LEVEL

9.40 STATISTICAL DATA FOR SELECTED RECEPTORS

9.41 CONTROL STRATEGY SUMMARY

9.42 SYMAP

Figure 9-42 illustrates the ground-level concentration pattern following application of an emission control strategy. This output pattern should be compared to Figure 9-26 to measure the effectiveness of the strategy.

Figure 9-1.

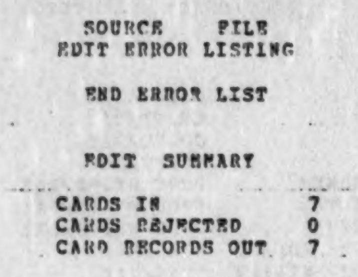
```
                    SOURCE    FILE
                         INPUT


9070000000000001DATE
9072800041000802           009P            010B            012    24.   E
90728000410013     2.56E   014    17.8 E   015   483.   E  016007
90728000410001CHEMICAL PLAN002T-BOILER     003    88.0 E   004    71.0 E
90728000410056    21.39E   057    33.79E   058    26.74E
90728000410063     6.47E   064     5.12E   033     2.9 E
90728000410062     4.09E
90728000410046   469.2 E
90728000410036     1.57E-02038     1.74E-04
90728000410030    23.   E 06
90728000410019    82.5 E   020   194.   E 03
90728000410022   567.   E 06023  8760.  E  026      3.0 E  027     6.59E
```

Figure 9-2.

```
                    SOURCE    FILE
                  DICTIONARY   LISTING

001  DESCRIPTION FIELD (1 OF 2)                             A   13 CHARACTERS
002  DESCRIPTION FIELD (2 OF 2)                             A   11 CHARACTERS
003  LOCATION X                  KILOMETERS                 N   0.00E 01 5.00E 02
004  LOCATION Y                  KILOMETERS                 N   0.00E 01 5.00E 02
005  AREA                        SQ KILOMETERS              N   0.00E 01 1.50E 04
006  LINE X                      KILOMETERS                 N   0.00E 01 5.00E 02
007  LINE Y                      KILOMETERS                 N   0.00E 01 5.00E 02
008  POLITICAL JURISDICTION                                 A   2 DIGITS
009  OWNERSHIP - 1 CHAR.         PRIV/LOC/ST/FED/UTIL       C  PLSFU
010  SOURCE TYPE - 1 CHAR.       FURNACE/MFG/INCINER        C  BPS
011  STACK HEIGHT LIMIT          METERS                     N   0.00E 01 5.00E 02
012  STACK HEIGHT                METERS                     N   0.00E 01 5.00E 02
013  STACK DIAMETER              METERS                     N   0.00E 01 2.00E 01
014  EXIT VELOCITY               METERS/SEC                 N   0.00E 01 2.50E 01
015  EXIT TEMPERATURE            DEG. KELVIN                N   2.90E 02 1.00E 03
016  EXISTING CONTROL DEVICE                                A   3 DIGITS
017  EXISTING SO2 CONTROL EFF.   PERCENTAGE                 N   0.00E 00 1.00E 02
018  EXISTING CO  CONTROL EFF.   PERCENTAGE                 N   0.00E 00 1.00E 02
019  EXISTING PART. CONTROL EFF.PERCENTAGE                  N   0.00E 00 1.00E 02
020  EXISTING -----* CONTR EFF.  PERCENTAGE                 N   0.00E 00 1.00E 02
021  EXHAUST GAS VOLUME          ACFM                       N   0.00E 00 3.00E 06
022  RATED CAPACITY              BTU/HR                     N   0.00E 00 1.00E 11
023  OPERATING TIME              HRS/YR                     N   0.00E 00 8.76E 03
024  SUMMER SHIFTS               SHIFTS/DAY                 N   0.00E 00 3.00E 00
025  WINTER SHIFTS               SHIFTS/DAY                 N   0.00E 00 3.00E 00
026  ANNUAL SHIFTS               SHIFTS/DAY                 N   0.00E 00 3.00E 00
027  ORIGINAL COAL COST          $/TON                      N   0.00E 00 2.50E 01
028  ORIGINAL OIL  COST          $/GAL                      N   0.00E 00 2.00E-01
029  ORIGINAL GAS  COST          $/CU FT                    N   0.00E 00 1.50E-03
030  ORIG  COAL HEAT   CONTENT   BTU/#                      N   0.00E 00 3.50E 07
031  ORIG  OIL  HEAT   CONTENT   BTU/GAL                    N   0.00E 00 2.00E 05
032  ORIG  GAS  HEAT   CONTENT   BTU/CU FT                  N   0.00E 00 1.20E 03
033  ORIG  COAL SULFUR CONTENT   PERCENTAGE                 N   0.00E 00 1.00E 01
034  ORIG  OIL  SULFUR CONTENT   PERCENTAGE                 N   0.00E 00 5.00E 00
035  ORIG  GAS  SULFUR CONTENT   PERCENTAGE                 N   0.00E 00 1.00E 00
036  ELECTRICITY COST            $/KW HR                    N   0.00E 00 5.00E-02
037  DEVICE FUEL COST            $/CU FT                    N   0.00E 00 1.50E-03
038  LIQUID COST                 $/GAL                      N   1.00E-04 3.00E-04
039  DISPOSAL FACTOR SO2         $/TON                      N  -5.00E 00 5.00E 00
040  DISPOSAL FACTOR CO          $/TON                      N  -5.00E 00 5.00E 00
041  DISPOSAL FACTOR PART.       $/TON                      N  -5.00E 00 5.00E 00
042  DISPOSAL FACTOR -----*      $/TON                      N  -5.00E 00 5.00E 00
043  MFG PROCESS UNITS - 1 CHAR TONS/BAR/BUSH/BAR/#         C  TAUCL
044  COAL RATE SUMMER            TONS/DAY                   N   0.00E 00 1.00E 05
045  COAL RATE WINTER            TONS/DAY                   N   0.00E 00 1.00E 05
046  COAL RATE ANNUAL            TONS/DAY                   N   0.00E 00 1.00E 05
047  OIL RATE SUMMER             GAL/DAY                    N   0.00E 00 1.50E 06
048  OIL RATE WINTER             GAL/DAY                    N   0.00E 00 1.50E 06
```

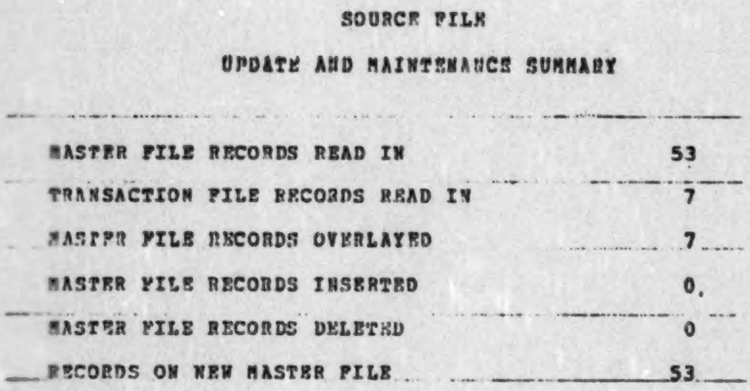
```
                    SOURCE   FILE
                  DICTIONARY   LISTING

049  OIL RATE ANNUAL             GAL/DAY               N   0.00E 00 1.50E 06
050  GAS RATE SUMMER             CU.FT/DAY             N   0.00E 00 1.70E 08
051  GAS RATE WINTER             CU.FT/DAY             N   0.00E 00 1.70E 08
052  GAS RATE ANNUAL             CU.FT/DAY             N   0.00E 00 1.70E 08
053  MATERIAL RATE SUMMER        PROC UNITS/DAY        N   0.00E 00 1.00E 06
054  MATERIAL RATE WINTER        PROC UNITS/DAY        N   0.00E 00 1.00E 06
055  MATERIAL RATE ANNUAL        PROC UNITS/DAY        N   0.00E 00 1.00E 06
056  EMISSION RATE SO2  SUMMER   TONS/DAY              N   0.00E 00 1.00E 03
057  EMISSION RATE SO2  WINTER   TONS/DAY              N   0.00E 00 1.00E 03
058  EMISSION RATE SO2  ANNUAL   TONS/DAY              N   0.00E 00 1.00E 03
059  EMISSION RATE CO   SUMMER   TONS/DAY              N   0.00E 00 1.00E 03
060  EMISSION RATE CO   WINTER   TONS/DAY              N   0.00E 00 1.00E 03
061  EMISSION RATE CO   ANNUAL   TONS/DAY              N   0.00E 00 1.00E 03
062  EMISSION RATE PART SUMMER   TONS/DAY              N   0.00E 00 1.00E 03
063  EMISSION RATE PART WINTER   TONS/DAY              N   0.00E 00 1.00E 03
064  EMISSION RATE PART ANNUAL   TONS/DAY              N   0.00E 00 1.00E 03
065  EMISSION RATE  -------*     TONS/DAY              N   0.00E 00 1.00E 03
066  EMISSION RATE  -------*     TONS/DAY              N   0.00E 00 1.00E 03
067  EMISSION RATE  -------*     TONS/DAY              N   0.00E 00 1.00E 03
```

Figure 9-3.



```
    SOURCE    FILE
 EDIT ERROR LISTING

   END ERROR LIST


   EDIT  SUMMARY

CARDS IN            7
CARDS REJECTED      0
CARD RECORDS OUT    7
```

Figure 9-4.



```
                    SOURCE FILE

           UPDATE AND MAINTENANCE SUMMARY

MASTER FILE RECORDS READ IN                    53
TRANSACTION FILE RECORDS READ IN                7
MASTER FILE RECORDS OVERLAYED                   7
MASTER FILE RECORDS INSERTED                    0
MASTER FILE RECORDS DELETED                     0
RECORDS ON NEW MASTER FILE                     53
```

Figure 9-5.

```
                                        SOURCE FILE LISTING                                    MARCH 13, 1978

    REGION   INSTALLATION TEST CASE          SOURCE ID  28000410           DESCRIPTIVE NAME  CHEMICAL PLANT-BOILER

  LOCATION X                 00088.00E 00   LOCATION Y                 00071.00E 00   AREA
  LINE X                                    LINE Y                                    POLITICAL JURISDICTION        02
  OWNERSHIP - 1 CHAR.        P              SOURCE TYPE - 1 CHAR.      B              STACK HEIGHT LIMIT
  STACK HEIGHT               00024.00E 00   STACK DIAMETER             00002.56E 00   EXIT VELOCITY                 00017.00E 00
  EXIT TEMPERATURE           00483.00E 00   EXISTING CONTROL DEVICE    007            EXISTING SO2 CONTROL EFF.
  EXISTING CO  CONTROL EFF.                 EXISTING PART. CONTROL EFF. 00082.50E 00  EXISTING ------* CONTR EFF.   00000.00E 00
  EXHAUST GAS VOLUME         00194.00E 03   RATED CAPACITY             00567.00E 06   OPERATING TIME                08760.00E 00
  SUMMER SHIFTS                             WINTER SHIFTS                             ANNUAL SHIFTS                 00003.00E 00
  ORIGINAL COAL COST         00006.59E 00   ORIGINAL OIL  COST                        ORIGINAL GAS  COST
  ORIG  COAL HEAT   CONTENT  00023.00E 06   ORIG  OIL  HEAT   CONTENT                 ORIG  GAS  HEAT   CONTENT
  ORIG  COAL SULFUR CONTENT  00002.90E 00   ORIG  OIL  SULFUR CONTENT                 ORIG  GAS  SULFUR CONTENT
  ELECTRICITY COST           00001.57E-02   DEVICE FUEL COST                          LIQUID COST                   00001.70E-08
  DISPOSAL FACTOR SO2                       DISPOSAL FACTOR CO                        DISPOSAL FACTOR PART.
  DISPOSAL FACTOR ------*                   MFG PROCESS UNITS - 1 CHAR                COAL RATE SUMMER
  COAL RATE WINTER                          COAL RATE ANNUAL           00469.20E 00   OIL RATE SUMMER
  OIL RATE WINTER                           OIL RATE ANNUAL                           GAS RATE SUMMER
  GAS RATE WINTER                           GAS RATE ANNUAL                           MATERIAL RATE SUMMER
  MATERIAL RATE WINTER                      MATERIAL RATE ANNUAL                      EMISSION RATE SO2  SUMMER     00021.39E 00
  EMISSION RATE SO2  WINTER  00033.79E 00   EMISSION RATE SO2  ANNUAL  00026.74E 00   EMISSION RATE CO   SUMMER
  EMISSION RATE CO   WINTER                 EMISSION RATE CO   ANNUAL                 EMISSION RATE PART SUMMER     00004.03E 00
  EMISSION RATE PART WINTER  00006.47E 00   EMISSION RATE PART ANNUAL  00005.12E 00   EMISSION RATE  ------*
  EMISSION RATE  ------*                    EMISSION RATE  ------*
```

```
                                          SOURCE FILE LISTING                                          MARCH 13, 1970

 REGION  INSTALLATION TEST CASE             SOURCE ID  28190330              DESCRIPTIVE NAME  E2309 PLANT-BOILER

 LOCATION X                  00088.30E 00   LOCATION Y                 00063.80E 00   AREA
 LINE X                                     LINE Y                                    POLITICAL JURISDICTION      02
 OWNERSHIP - 1 CHAR.         P              SOURCE TYPE - 1 CHAR.      B              STACK HEIGHT LIMIT
 STACK HEIGHT                00024.00E 00   STACK DIAMETER             00002.50E 00   EXIT VELOCITY        .     00017.80E 00
 EXIT TEMPERATURE            00489.00E 00   EXISTING CONTROL DEVICE    006            EXISTING SO2 CONTROL EFF.
 EXISTING CO  CONTROL EFF.                  EXISTING PART. CONTROL EFF. 00047.50E 00  EXISTING ------* CONTR EFF.  00000.00E 00
 EXHAUST GAS VOLUME          00182.50E 03   RATED CAPACITY             00485.00E 06   OPERATING TIME             08760.00E 00
 SUMMER SHIFTS                              WINTER SHIFTS                             ANNUAL SHIFTS              00003.00E 00
 ORIGINAL COAL COST          00006.59E 00   ORIGINAL OIL  COST                        ORIGINAL GAS  COST
 ORIG  COAL HEAT   CONTENT   00023.00E 06   ORIG  OIL  HEAT   CONTENT                 ORIG  GAS  HEAT   CONTENT
 ORIG  COAL SULFUR CONTENT   00002.90E 00   ORIG  OIL  SULFUR CONTENT                 ORIG  GAS  SULFUR CONTENT
 ELECTRICITY COST            00001.65E-02   DEVICE FUEL COST                          LIQUID COST                00001.74E-04
 DISPOSAL FACTOR SO2                        DISPOSAL FACTOR CO                        DISPOSAL FACTOR PART.
 DISPOSAL FACTOR ------*                    MFG PROCESS UNITS - 1 CHAR                COAL RATE SUMMER
 COAL RATE WINTER                           COAL RATE ANNUAL           00506.80E 00   OIL RATE SUMMER
 OIL RATE WINTER                            OIL RATE ANNUAL                           GAS RATE SUMMER
 GAS RATE WINTER                            GAS RATE ANNUAL                           MATERIAL RATE SUMMER
 MATERIAL RATE WINTER                       MATERIAL RATE ANNUAL                      EMISSION RATE SO2  SUMMER  00031.69E 00
 EMISSION RATE SO2  WINTER   00031.69E 00   EMISSION RATE SO2  ANNUAL  00031.69E 00   EMISSION RATE CO   SUMMER
 EMISSION RATE CO   WINTER                  EMISSION RATE CO   ANNUAL                 EMISSION RATE PART SUMMER  00019.26E 00
 EMISSION RATE PART WINTER   00019.26E 00   EMISSION RATE PART ANNUAL  00019.26E 00   EMISSION RATE  ------*
 EMISSION RATE  ------*                     EMISSION RATE  ------*
```

```
                                     SOURCE FILE LISTING                                      MARCH 13, 1970

    REGION  INSTALLATION TEST CASE         SOURCE ID  28190331              DESCRIPTIVE NAME  H2SO4 PLANT

LOCATION X                  00088.30E 00     LOCATION Y                  00063.80E 00     AREA
LINE X                                       LINE Y                                       POLITICAL JURISDICTION     02
OWNERSHIP - 1 CHAR.         P                SOURCE TYPE - 1 CHAR.       P                STACK HEIGHT LIMIT
STACK HEIGHT                00030.00E 00     STACK DIAMETER              06001.06E 00     EXIT VELOCITY               00015.20E 00
EXIT TEMPERATURE            00362.00E 00     EXISTING CONTROL DEVICE     018              EXISTING SO2 CONTROL EFF.
EXISTING CO  CONTROL EFF.                    EXISTING PART. CONTROL EFF. 00093.70E 00     EXISTING -----* CONTR EFF.  00000.00E 00
EXHAUST GAS VOLUME          00086.10E 03     RATED CAPACITY                               OPERATING TIME              08760.00E 00
SUMMER SHIFTS                                WINTER SHIFTS                                ANNUAL SHIFTS               00003.00E 00
ORIGINAL COAL COST                           ORIGINAL OIL  COST                           ORIGINAL GAS  COST
ORIG  COAL HEAT   CONTENT                    ORIG  OIL  HEAT   CONTENT                    ORIG  GAS  HEAT   CONTENT
ORIG  COAL SULFUR CONTENT                    ORIG  OIL  SULFUR CONTENT                    ORIG  GAS  SULFUR CONTENT
ELECTRICITY COST            00001.65E-02     DEVICE FUEL COST                             LIQUID COST                 00001.74E-04
DISPOSAL FACTOR SO2                          DISPOSAL FACTOR CO                           DISPOSAL FACTOR PART.
DISPOSAL FACTOR -----*                       MFG PROCESS UNITS - 1 CHAR  T                COAL RATE SUMMER
COAL RATE WINTER                             COAL RATE ANNUAL                             OIL RATE SUMMER
OIL RATE WINTER                              OIL RATE ANNUAL                              GAS RATE SUMMER
GAS RATE WINTER                              GAS RATE ANNUAL                              MATERIAL RATE SUMMER
MATERIAL RATE WINTER                         MATERIAL RATE ANNUAL        01100.00E 00     EMISSION RATE SO2  SUMMER   00019.10E 00
EMISSION RATE SO2  WINTER   00019.10E 00     EMISSION RATE SO2  ANNUAL   00019.10E 00     EMISSION RATE CO   SUMMER
EMISSION RATE CO   WINTER                    EMISSION RATE CO   ANNUAL                    EMISSION RATE PART SUMMER   00000.26E 00
EMISSION RATE PART WINTER   00000.26E 00     EMISSION RATE PART ANNUAL   00000.26E 00     EMISSION RATE  ------*
EMISSION RATE  ------*                       EMISSION RATE  ------*
```

```
                                            SOURCE FILE LISTING                                       MARCH 13, 1978

   REGION   INSTALLATION TEST CASE           SOURCE ID  28190340              DESCRIPTIVE NAME  H2SO4 PLANT BOILER

 LOCATION X                 00080.80E 00    LOCATION Y                 00057.00E 00    AREA
 LINE X                                     LINE Y                                     POLITICAL JURISDICTION      01
 OWNERSHIP - 1 CHAR.          P             SOURCE TYPE - 1 CHAR.        B             STACK HEIGHT LIMIT
 STACK HEIGHT               00024.00E 00    STACK DIAMETER             00002.20E 00    EXIT VELOCITY             00017.80E 00
 EXIT TEMPERATURE           00500.00E 00    EXISTING CONTROL DEVICE    007             EXISTING SO2 CONTROL EFF.
 EXISTING CO  CONTROL EFF.                  EXISTING PART. CONTROL EFF. 00081.30E 00   EXISTING ------* CONTR EFF.  00000.00E 00
 EXHAUST GAS VOLUME         00086.20E 03    RATED CAPACITY             00358.40E 06    OPERATING TIME            00760.00E 00
 SUMMER SHIFTS                              WINTER SHIFTS                              ANNUAL SHIFTS             00003.00E 00
 ORIGINAL COAL COST         00006.59E 00    ORIGINAL OIL  COST         00006.67E-02    ORIGINAL GAS  COST        00005.50E-04
 ORIG  COAL HEAT  CONTENT   00023.00E 06    ORIG  OIL  HEAT  CONTENT   00152.00E 03    ORIG  GAS  HEAT  CONTENT  00001.00E 03
 ORIG  COAL SULFUR CONTENT  00002.90E 00    ORIG  OIL  SULFUR CONTENT  00001.90E 00    ORIG  GAS  SULFUR CONTENT
 ELECTRICITY COST           00001.65E-02    DEVICE FUEL COST                           LIQUID COST               00001.74E-04
 DISPOSAL FACTOR SO2                        DISPOSAL FACTOR CO                         DISPOSAL FACTOR PART.
 DISPOSAL FACTOR ------*                    MFG PROCESS UNITS - 1 CHAR                 COAL RATE SUMMER
 COAL RATE WINTER                           COAL RATE ANNIAL           00350.70E 00    OIL RATE SUMMER
 OIL RATE WINTER                            OIL RATE ANNUAL            02553.00E 00    GAS RATE SUMMER
 GAS RATE WINTER                            GAS RATE ANNUAL            08000.00E 00    MATERIAL RATE SUMMER
 MATERIAL RATE WINTER                       MATERIAL RATE ANNUAL                       EMISSION RATE SO2  SUMMER  00020.36E 00
 EMISSION RATE SO2  WINTER  00020.36E 00    EMISSION RATE SO2  ANNUAL  00020.36E 00    EMISSION RATE CO   SUMMER
 EMISSION RATE CO   WINTER                  EMISSION RATE CO   ANNUAL                  EMISSION RATE PART SUMMER  00003.90E 00
 EMISSION RATE PART WINTER  00003.90E 00    EMISSION RATE PART ANNUAL  00003.90E 00    EMISSION RATE  ------*
 EMISSION RATE  ------*                     EMISSION RATE  ------*
```

```
                                         SOURCE FILE LISTING                                         MARCH 13, 1970

     REGION   INSTALLATION TEST CASE            SOURCE ID  28190341            DESCRIPTIVE NAME  H2SO4 PLANT
  LOCATION X                  00080.80E 00  LOCATION Y                  00057.00E 00  AREA
  LINE X                                    LINE Y                                    POLITICAL JURISDICTION      01
  OWNERSHIP - 1 CHAR.         P             SOURCE TYPE - 1 CHAR.       P             STACK HEIGHT LIMIT
  STACK HEIGHT                00030.00E 00  STACK DIAMETER              00001.86E 00  EXIT VELOCITY               00015.20E 00
  EXIT TEMPERATURE            00361.00E 00  EXISTING CONTROL DEVICE                   EXISTING SO2 CONTROL EFF.
  EXISTING CO  CONTROL EFF.                 EXISTING PART. CONTROL EFF.               EXISTING ------* CONTR EFF.  00000.00E 00
  EXHAUST GAS VOLUME          00086.10E 03  RATED CAPACITY                            OPERATING TIME              08760.00E 00
  SUMMER SHIFTS                             WINTER SHIFTS                             ANNUAL SHIFTS               00003.00E 00
  ORIGINAL COAL COST                        ORIGINAL OIL  COST                        ORIGINAL GAS  COST
  ORIG  COAL HEAT   CONTENT                 ORIG  OIL  HEAT   CONTENT                 ORIG  GAS  HEAT   CONTENT
  ORIG  COAL SULFUR CONTENT                 ORIG  OIL  SULFUR CONTENT                 ORIG  GAS  SULFUR CONTENT
  ELECTRICITY COST            00001.65E-02  DEVICE FUEL COST                          LIQUID COST                 00001.74E-04
  DISPOSAL FACTOR SO2                       DISPOSAL FACTOR CO                        DISPOSAL FACTOR PART.
  DISPOSAL FACTOR ------*                   EPG PROCESS UNITS - 1 CHAR  T             COAL RATE SUMMER
  COAL RATE WINTER                          COAL RATE ANNUAL                          OIL RATE SUMMER
  OIL RATE WINTER                           OIL RATE ANNUAL                           GAS RATE SUMMER
  GAS RATE WINTER                           GAS RATE ANNUAL                           MATERIAL RATE SUMMER
  MATERIAL RATE WINTER                      MATERIAL RATE ANNUAL        01000.00E 00  EMISSION RATE SO2  SUMMER   00023.70E 00
  EMISSION RATE SO2  WINTER   00023.70E 00  EMISSION RATE SO2  ANNUAL   00023.70E 00  EMISSION RATE CO   SUMMER   00000.00E 00
  EMISSION RATE CO   WINTER   00000.00E 00  EMISSION RATE CO   ANNUAL                 EMISSION RATE PART SUMMER   00000.21E 00
  EMISSION RATE PART WINTER   00000.21E 00  EMISSION RATE PART ANNUAL   00000.21E 00  EMISSION RATE  ------*
  EMISSION RATE  ------*                    EMISSION RATE  ------*
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                                        SOURCE FILE LISTING                                     MARCH 13, 1970

    REGION   INSTALLATION TEST CASE             SOURCE ID  28191602              DESCRIPTIVE NAME  HNO3 PLANT

  LOCATION X                00071.50E 00    LOCATION Y                00031.70E 00    AREA
  LINE X                                    LINE Y                                    POLITICAL JURISDICTION      01
  OWNERSHIP - 1 CHAR.         P             SOURCE TYPE - 1 CHAR.       P             STACK HEIGHT LIMIT
  STACK HEIGHT              00023.00E 00    STACK DIAMETER            00002.10E 00    EXIT VELOCITY               00015.20E 00
  EXIT TEMPERATURE          00505.00E 00    EXISTING CONTROL DEVICE                   EXISTING SO2 CONTROL EFF.
  EXISTING CO  CONTROL EFF.                 EXISTING PART. CONTROL EFF.               EXISTING -----* CONTR EFF.  00000.00E 00
  EXHAUST GAS VOLUME        00109.90E 03    RATED CAPACITY                            OPERATING TIME              08760.00E 00
  SUMMER SHIFTS                             WINTER SHIFTS                             ANNUAL SHIFTS               00003.00E 00
  ORIGINAL COAL COST                        ORIGINAL OIL  COST                        ORIGINAL GAS  COST
  ORIG  COAL HEAT   CONTENT                 ORIG  OIL  HEAT   CONTENT                 ORIG  GAS  HEAT   CONTENT
  ORIG  COAL SULFUR CONTENT                 ORIG  OIL  SULFUR CONTENT                 ORIG  GAS  SULFUR CONTENT
  ELECTRICITY COST          00001.57E-02    DEVICE FUEL COST                          LIQUID COST                 00001.74E-04
  DISPOSAL FACTOR SO2                       DISPOSAL FACTOR CO                        DISPOSAL FACTOR PART.
  DISPOSAL FACTOR -----*                    MFG PROCESS UNITS - 1 CHAR  T             COAL RATE SUMMER
  COAL RATE WINTER                          COAL RATE ANNIAL                          OIL RATE SUMMER
  OIL RATE WINTER                           OIL RATE ANNUAL                           GAS RATE SUMMER
  GAS RATE WINTER                           GAS RATE ANNUAL                           MATERIAL RATE SUMMER
  MATERIAL RATE WINTER                      MATERIAL RATE ANNUAL      00675.00E 00    EMISSION RATE SO2  SUMMER
  EMISSION RATE SO2  WINTER                 EMISSION RATE SO2  ANNUAL                 EMISSION RATE CO   SUMMER
  EMISSION RATE CO   WINTER                 EMISSION RATE CO   ANNUAL                 EMISSION RATE PART SUMMER   00021.90E 00
  EMISSION RATE PART WINTER 00021.90E 00    EMISSION RATE PART ANNUAL 00021.90E 00    EMISSION RATE  ------*
  EMISSION RATE  ------*                    EMISSION RATE  ------*
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                                          SOURCE FILE LISTING                                        MARCH 13, 1970

    REGION   INSTALLATION TEST CASE             SOURCE ID  28712601             DESCRIPTIVE NAME  FERTILIZER PLANT

  LOCATION X                  00090.30E 00   LOCATION Y                 00070.00E 00   AREA
  LINE X                                     LINE Y                                    POLITICAL JURISDICTION      02
  OWNERSHIP - 1 CHAR.         P              SOURCE TYPE - 1 CHAR.      P              STACK HEIGHT LIMIT
  STACK HEIGHT                00010.00E 00   STACK DIAMETER             00002.06E 00   EXIT VELOCITY                  00015.20E 00
  EXIT TEMPERATURE            00325.00E 00   EXISTING CONTROL DEVICE    007            EXISTING SO2 CONTROL EFF.
  EXISTING CO  CONTROL EFF.                  EXISTING PART. CONTROL EFF. 00080.00E 00  EXISTING ------* CONTR EFF.    00080.00E 00
  EXHAUST GAS VOLUME          00107.00E 03   RATED CAPACITY                            OPERATING TIME                 08760.00E 00
  SUMMER SHIFTS                              WINTER SHIFTS                             ANNUAL SHIFTS                  00003.03E 00
  ORIGINAL COAL COST                         ORIGINAL OIL  COST                        ORIGINAL GAS  COST
  ORIG  COAL HEAT   CONTENT                  ORIG  OIL  HEAT   CONTENT                 ORIG  GAS  HEAT   CONTENT
  ORIG  COAL SULFUR CONTENT                  ORIG  OIL  SULFUR CONTENT                 ORIG  GAS  SULFUR CONTENT
  ELECTRICITY COST            00001.65E-02   DEVICE FUEL COST                          LIQUID COST                    00001.74E-04
  DISPOSAL FACTOR SO2                        DISPOSAL FACTOR CO                        DISPOSAL FACTOR PART.
  DISPOSAL FACTOR ------*                    NPG PROCESS UNITS - 1 CHAR  T             COAL RATE SUMMER
  COAL RATE WINTER                           COAL RATE ANNUAL                          OIL RATE SUMMER
  OIL RATE WINTER                            OIL RATE ANNUAL                           GAS RATE SUMMER
  GAS RATE WINTER                            GAS RATE ANNUAL                           MATERIAL RATE SUMMER
  MATERIAL RATE WINTER                       MATERIAL RATE ANNUAL       00164.00E 00   EMISSION RATE SO2  SUMMER
  EMISSION RATE SO2  WINTER                  EMISSION RATE SO2  ANNUAL                 EMISSION RATE CO   SUMMER
  EMISSION RATE CO   WINTER                  EMISSION RATE CO   ANNUAL                 EMISSION RATE PART SUMMER      00008.00E 00
  EMISSION RATE PART WINTER   00008.00E 00   EMISSION RATE PART ANNUAL  00008.00E 00   EMISSION RATE  ------*
  EMISSION RATE  ------*                     EMISSION RATE  ------*
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                                        SOURCE FILE LISTING                                              MARCH 13, 1978

  REGION   INSTALLATION TEST CASE              SOURCE ID  29110611                 DESCRIPTIVE NAME  OIL REFINERY
LOCATION X                     00097.30E 00    LOCATION Y                   00090.50E 00    AREA
LINE X                                         LINE Y                                       POLITICAL JURISDICTION      02
OWNERSHIP - 1 CHAR.          P                 SOURCE TYPE - 1 CHAR.        P               STACK HEIGHT LIMIT
STACK HEIGHT                   00030.00E 00    STACK DIAMETER               00007.36E 00    EXIT VELOCITY                00015.20E 00
EXIT TEMPERATURE               00811.00E 00    EXISTING CONTROL DEVICE      007             EXISTING SO2 CONTROL EFF.
EXISTING CO  CONTROL EFF.                      EXISTING PART. CONTROL EFF.  00098.00E 00    EXISTING ------* CONTR EFF.  00000.00E 00
EXHAUST GAS VOLUME             00001.36E 06    RATED CAPACITY                               OPERATING TIME               08760.00E 00
SUMMER SHIFTS                                  WINTER SHIFTS                                ANNUAL SHIFTS                00003.00E 00
ORIGINAL COAL COST                             ORIGINAL OIL  COST                           ORIGINAL GAS  COST
ORIG  COAL HEAT   CONTENT                      ORIG  OIL  HEAT  CONTENT                     ORIG  GAS  HEAT  CONTENT
ORIG  COAL SULFUR CONTENT                      ORIG  OIL  SULFUR CONTENT                    ORIG  GAS  SULFUR CONTENT
ELECTRICITY COST               00001.57E-02    DEVICE FUEL COST                             LIQUID COST                  00001.74E-04
DISPOSAL FACTOR SO2                            DISPOSAL FACTOR CO                           DISPOSAL FACTOR PART.
DISPOSAL FACTOR ------*                        MFG PROCESS UNITS - 1 CHAR  A                COAL RATE SUMMER
COAL RATE WINTER                               COAL RATE ANNUAL                             OIL RATE SUMMER
OIL RATE WINTER                                OIL RATE ANNUAL                              GAS RATE SUMMER
GAS RATE WINTER                                GAS RATE ANNUAL                              MATERIAL RATE SUMMER
MATERIAL RATE WINTER                           MATERIAL RATE ANNUAL         00194.00E 03    EMISSION RATE SO2  SUMMER
EMISSION RATE SO2  WINTER                      EMISSION RATE SO2  ANNUAL                    EMISSION RATE CO   SUMMER    00521.00E 00
EMISSION RATE CO   WINTER      00521.00E 00    EMISSION RATE CO   ANNUAL    00521.00E 00    EMISSION RATE PART SUMMER    00000.12E 00
EMISSION RATE PART WINTER      00000.12E 00    EMISSION RATE PART ANNUAL    00000.12E 00    EMISSION RATE  ------*
EMISSION RATE  ------*                         EMISSION RATE  ------*
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                                        SOURCE FILE LISTING                                          MARCH 13, 1970

   REGION   INSTALLATION TEST CASE           SOURCE ID  29511501            DESCRIPTIVE NAME  ASPHALT BATCHING

LOCATION X                 00068.00E 00    LOCATION Y                00054.30E 00    AREA
LINE X                                     LINE Y                                    POLITICAL JURISDICTION      01
OWNERSHIP - 1 CHAR.        P               SOURCE TYPE - 1 CHAR.     P               STACK HEIGHT LIMIT
STACK HEIGHT               00018.00E 00    STACK DIAMETER            00000.96E 00    EXIT VELOCITY              00017.80E 00
EXIT TEMPERATURE           00394.00E 00    EXISTING CONTROL DEVICE                   EXISTING SO2 CONTROL EFF.
EXISTING CO  CONTROL EFF.                  EXISTING PART. CONTROL EFF.               EXISTING ------* CONTR EFF.  00000.00E 00
EXHAUST GAS VOLUME         00026.90E 03    RATED CAPACITY                            OPERATING TIME             01460.00E 00
SUMMER SHIFTS                              WINTER SHIFTS                             ANNUAL SHIFTS              00000.50E 00
ORIGINAL COAL COST                         ORIGINAL OIL  COST                        ORIGINAL GAS  COST
ORIG  COAL HEAT   CONTENT                  ORIG  OIL  HEAT   CONTENT                 ORIG  GAS  HEAT   CONTENT
ORIG  COAL SULFUR CONTENT                  ORIG  OIL  SULFUR CONTENT                 ORIG  GAS  SULFUR CONTENT
ELECTRICITY COST           00001.68E-02    DEVICE FUEL COST                          LIQUID COST                00001.74E-04
DISPOSAL FACTOR SO2                        DISPOSAL FACTOR CO                        DISPOSAL FACTOR PART.
DISPOSAL FACTOR ------*                    RFG PROCESS UNITS - 1 CHAR  T             COAL RATE SUMMER
COAL RATE WINTER                           COAL RATE ANNIAL                          OIL RATE SUMMER
OIL RATE WINTER                            OIL RATE ANNUAL                           GAS RATE SUMMER
GAS RATE WINTER                            GAS RATE ANNUAL                           MATERIAL RATE SUMMER
MATERIAL RATE WINTER                       MATERIAL RATE ANNUAL      00110.00E 00    EMISSION RATE SO2  SUMMER
EMISSION RATE SO2  WINTER                  EMISSION RATE SO2  ANNUAL                 EMISSION RATE CO   SUMMER
EMISSION RATE CO   WINTER                  EMISSION RATE CO   ANNUAL                 EMISSION RATE PART SUMMER  00001.95E 00
EMISSION RATE PART WINTER                  EMISSION RATE PART ANNUAL 00000.97E 00    EMISSION RATE  ------*
EMISSION RATE  ------*                     EMISSION RATE  ------*
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                                   SOURCE FILE LISTING                                            MARCH 13, 1970

    REGION   INSTALLATION TEST CASE            SOURCE ID  32411001              DESCRIPTIVE NAME  [illegible]

LOCATION X                00085.20E 00   LOCATION Y                  00078.90E 00   AREA
LINE X                                   LINE Y                                     POLITICAL JURISDICTION      01
OWNERSHIP - 1 CHAR.       P              SOURCE TYPE - 1 CHAR.       P              STACK HEIGHT LIMIT
STACK HEIGHT              00061.00E 00   STACK DIAMETER              00003.44E 00   EXIT VELOCITY               00015.20E 00
EXIT TEMPERATURE          00561.00E 00   EXISTING CONTROL DEVICE     010            EXISTING SO2 CONTROL EFF.
EXISTING CO  CONTROL EFF.                EXISTING PART. CONTROL EFF. 00098.00E 00   EXISTING -----* CONTR EFF.  [illegible].00E 00
EXHAUST GAS VOLUME        00298.00E 03   RATED CAPACITY                             OPERATING TIME              08760.00E 00
SUMMER SHIFTS                            WINTER SHIFTS                              ANNUAL SHIFTS               00003.00E 00
ORIGINAL COAL COST                       ORIGINAL OIL  COST                         ORIGINAL GAS  COST
ORIG  COAL HEAT   CONTENT                ORIG  OIL  HEAT   CONTENT                  ORIG  GAS  HEAT   CONTENT
ORIG  COAL SULFUR CONTENT                ORIG  OIL  SULFUR CONTENT                  ORIG  GAS  SULFUR CONTENT
ELECTRICITY COST          00001.57E-02   DEVICE FUEL COST                           LIQUID COST                 00001.74E-06
DISPOSAL FACTOR SO2                      DISPOSAL FACTOR CO                         DISPOSAL FACTOR PART.
DISPOSAL FACTOR -----*                   MPG PROCESS UNITS - 1 CHAR  C              COAL RATE SUMMER
COAL RATE WINTER                         COAL RATE ANNUAL                           OIL RATE SUMMER
OIL RATE WINTER                          OIL RATE ANNUAL                            GAS RATE SUMMER
GAS RATE WINTER                          GAS RATE ANNUAL                            MATERIAL RATE SUMMER
MATERIAL RATE WINTER                     MATERIAL RATE ANNUAL        05480.00E 00   EMISSION RATE SO2  SUMMER
EMISSION RATE SO2  WINTER                EMISSION RATE SO2  ANNUAL                  EMISSION RATE CO   SUMMER
EMISSION RATE CO   WINTER                EMISSION RATE CO   ANNUAL                  EMISSION RATE PART SUMMER   00002.79E 00
EMISSION RATE PART WINTER 00002.79E 00   EMISSION RATE PART ANNUAL   00002.79E 00   EMISSION RATE  ------*
EMISSION RATE  ------*                   EMISSION RATE  ------*
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                                     SOURCE FILE LISTING                                    MARCH 13, 1970

    REGION   INSTALLATION TEST CASE       SOURCE ID  32950511            DESCRIPTIVE NAME  ROCK SAND AND GRAVEL

 LOCATION X                  00083.10E 00   LOCATION Y                  00091.20E 00   AREA
 LINE X                                     LINE Y                                     POLITICAL JURISDICTION       01
 OWNERSHIP - 1 CHAR.      P                 SOURCE TYPE - 1 CHAR.       P              STACK HEIGHT LIMIT
 STACK HEIGHT                00012.00E 00   STACK DIAMETER              00000.21E 00   EXIT VELOCITY                00017.80E 00
 EXIT TEMPERATURE            00294.00E 00   EXISTING CONTROL DEVICE                    EXISTING SO2 CONTROL EFF.
 EXISTING CO  CONTROL EFF.                  EXISTING PART. CONTROL EFF.                EXISTING ------* CONTR EFF.  00000.00E 00
 EXHAUST GAS VOLUME          00187.50E 03   RATED CAPACITY                             OPERATING TIME               02920.00E 00
 SUMMER SHIFTS                              WINTER SHIFTS                              ANNUAL SHIFTS                00001.00E 00
 ORIGINAL COAL COST                         ORIGINAL OIL  COST                         ORIGINAL GAS  COST
 ORIG  COAL HEAT   CONTENT                  ORIG  OIL  HEAT   CONTENT                  ORIG  GAS  HEAT   CONTENT
 ORIG  COAL SULFUR CONTENT                  ORIG  OIL  SULFUR CONTENT                  ORIG  GAS  SULFUR CONTENT
 ELECTRICITY COST            00001.60E-02   DEVICE FUEL COST                           LIQUID COST                  00001.74E-04
 DISPOSAL FACTOR SO2                        DISPOSAL FACTOR CO                         DISPOSAL FACTOR PART.
 DISPOSAL FACTOR ------*                    MPG PROCESS UNITS - 1 CHAR  T              COAL RATE SUMMER
 COAL RATE WINTER                           COAL RATE ANNIAL                           OIL RATE SUMMER
 OIL RATE WINTER                            OIL RATE ANNUAL                            GAS RATE SUMMER
 GAS RATE WINTER                            GAS RATE ANNUAL                            MATERIAL RATE SUMMER
 MATERIAL RATE WINTER                       MATERIAL RATE ANNUAL        01918.00E 00   EMISSION RATE SO2  SUMMER
 EMISSION RATE SO2  WINTER                  EMISSION RATE SO2  ANNUAL                  EMISSION RATE CO   SUMMER
 EMISSION RATE CO   WINTER                  EMISSION RATE CO   ANNUAL                  EMISSION RATE PART SUMMER    00019.10E 00
 EMISSION RATE PART WINTER   00019.18E 00   EMISSION RATE PART ANNUAL   00019.18E 00   EMISSION RATE  ------*
 EMISSION RATE  ------*                     EMISSION RATE  ------*
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                                   SOURCE FILE LISTING                                        MARCH 13, 1978

 1   REGION   INSTALLATION TEST CASE          SOURCE ID  33121111            DESCRIPTIVE NAME  STEEL MILL-BLAST FURNACE

 LOCATION X                00092.10E 00   LOCATION Y                00074.20E 00   AREA
 LINE X                                   LINE Y                                   POLITICAL JURISDICTION     02
 OWNERSHIP - 1 CHAR.       P              SOURCE TYPE - 1 CHAR.     P              STACK HEIGHT LIMIT
 STACK HEIGHT              00030.00E 00   STACK DIAMETER            00004.54E 00   EXIT VELOCITY              00017.80E 00
 EXIT TEMPERATURE          00477.00E 00   EXISTING CONTROL DEVICE   001            EXISTING SO2 CONTROL EFF.
 EXISTING CO  CONTROL EFF.                EXISTING PART. CONTROL EFF. 00099.70E 00 EXISTING -----* CONTR EFF. 00000.00E 00
 EXHAUST GAS VOLUME        00600.00E 03   RATED CAPACITY                           OPERATING TIME             08760.00E 00
 SUMMER SHIFTS                            WINTER SHIFTS                            ANNUAL SHIFTS              00003.00E 00
 ORIGINAL COAL COST                       ORIGINAL OIL  COST                       ORIGINAL GAS  COST
 ORIG  COAL HEAT   CONTENT                ORIG  OIL  HEAT   CONTENT                ORIG  GAS  HEAT   CONTENT
 ORIG  COAL SULFUR CONTENT                ORIG  OIL  SULFUR CONTENT                ORIG  GAS  SULFUR CONTENT
 ELECTRICITY COST          00001.57E-02   DEVICE FUEL COST                         LIQUID COST                00001.74E-04
 DISPOSAL FACTOR SO2                      DISPOSAL FACTOR CO                       DISPOSAL FACTOR PART.
 DISPOSAL FACTOR -----*                   MFG PROCESS UNITS - 1 CHAR  T            COAL RATE SUMMER
 COAL RATE WINTER                         COAL RATE ANNIAL                         OIL RATE SUMMER
 OIL RATE WINTER                          OIL RATE ANNUAL                          GAS RATE SUMMER
 GAS RATE WINTER                          GAS RATE ANNUAL                          MATERIAL RATE SUMMER
 MATERIAL RATE WINTER                     MATERIAL RATE ANNUAL      03450.00E 00   EMISSION RATE SO2  SUMMER
 EMISSION RATE SO2  WINTER                EMISSION RATE SO2  ANNUAL                EMISSION RATE CO   SUMMER
 EMISSION RATE CO   WINTER                EMISSION RATE CO   ANNUAL                EMISSION RATE PART SUMMER  00001.00E 00
 EMISSION RATE PART WINTER 00001.00E 00   EMISSION RATE PART ANNUAL 00001.00E 00   EMISSION RATE  ------*
 EMISSION RATE  ------*                   EMISSION RATE  ------*
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                                       SOURCE FILE LISTING                                    MARCH 13, 1978

  REGION   INSTALLATION TEST CASE        SOURCE ID  33121112          DESCRIPTIVE NAME  STEEL MILL-BOF

  LOCATION X              00092.10E 00   LOCATION Y                 00074.20E 00   AREA
  LINE X                                 LINE Y                                    POLITICAL JURISDICTION     02
  OWNERSHIP - 1 CHAR.        P           SOURCE TYPE - 1 CHAR.         P           STACK HEIGHT LIMIT
  STACK HEIGHT            00030.00E 00   STACK DIAMETER             00005.35E 00   EXIT VELOCITY            00017.80E 00
  EXIT TEMPERATURE        00527.00E 00   EXISTING CONTROL DEVICE      010          EXISTING SO2 CONTROL EFF.
  EXISTING CO  CONTROL EFF.              EXISTING PART. CONTROL EFF. 00099.30E 00  EXISTING ------* COSTS EFF.  00000.00E 00
  EXHAUST GAS VOLUME      00035.00E 03   RATED CAPACITY                            OPERATING TIME           08760.00E 00
  SUMMER SHIFTS                          WINTER SHIFTS                             ANNUAL SHIFTS            00003.00E 00
  ORIGINAL COAL COST                     ORIGINAL OIL  COST                        ORIGINAL GAS  COST
  ORIG  COAL HEAT   CONTENT              ORIG  OIL  HEAT   CONTENT                 ORIG  GAS  HEAT   CONTENT
  ORIG  COAL SULFUR CONTENT              ORIG  OIL  SULFUR CONTENT                 ORIG  GAS  SULFUR CONTENT
  ELECTRICITY COST        00001.57E-02   DEVICE FUEL COST                          LIQUID COST              00001.74E-04
  DISPOSAL FACTOR SO2                    DISPOSAL FACTOR CO                        DISPOSAL FACTOR PART.
  DISPOSAL FACTOR -----*                 MFG PROCESS UNITS - 1 CHAR  T             COAL RATE SUMMER
  COAL RATE WINTER                       COAL RATE ANNUAL                          OIL RATE SUMMER
  OIL RATE WINTER                        OIL RATE ANNUAL                           GAS RATE SUMMER
  GAS RATE WINTER                        GAS RATE ANNUAL                           MATERIAL RATE SUMMER
  MATERIAL RATE WINTER                   MATERIAL RATE ANNUAL       05280.00E 00   EMISSION RATE SO2  SUMMER
  EMISSION RATE SO2  WINTER              EMISSION RATE SO2  ANNUAL                 EMISSION RATE CO   SUMMER
  EMISSION RATE CO   WINTER              EMISSION RATE CO   ANNUAL                 EMISSION RATE PART SUMMER  00000.74E 00
  EMISSION RATE PART WINTER 00000.74E 00 EMISSION RATE PART ANNUAL  00000.74E 00   EMISSION RATE  ------*
  EMISSION RATE  ------*                 EMISSION RATE  ------*
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                                        SOURCE FILE LISTING                                    MARCH 13, 1978

    REGION   INSTALLATION TEST CASE          SOURCE ID  33121113              DESCRIPTIVE NAME  STEEL MILL-SINTERER

 LOCATION X                   00092.10E 00   LOCATION Y                   00074.20E 00   AREA
 LINE X                                      LINE Y                                      POLITICAL JURISDICTION      02
 OWNERSHIP - 1 CHAR.          P              SOURCE TYPE - 1 CHAR.        P              STACK HEIGHT LIMIT
 STACK HEIGHT                 00030.00E 00   STACK DIAMETER               00003.60E 00   EXIT VELOCITY               00017.00E 00
 EXIT TEMPERATURE             00444.00E 00   EXISTING CONTROL DEVICE      007            EXISTING SO2 CONTROL EFF.
 EXISTING CO  CONTROL EFF.                   EXISTING PART. CONTROL EFF.  00082.90E 00   EXISTING -----* CONTR EFF.  00000.00E 00
 EXHAUST GAS VOLUME           00388.00E 03   RATED CAPACITY                              OPERATING TIME              08760.00E 00
 SUMMER SHIFTS                               WINTER SHIFTS                               ANNUAL SHIFTS               00003.00E 00
 ORIGINAL COAL COST                          ORIGINAL OIL  COST                          ORIGINAL GAS  COST
 ORIG  COAL HEAT   CONTENT                   ORIG  OIL  HEAT  CONTENT                    ORIG  GAS  HEAT  CONTENT
 ORIG  COAL SULFUR CONTENT                   ORIG  OIL  SULFUR CONTENT                   ORIG  GAS  SULFUR CONTENT
 ELECTRICITY COST             00001.57E-02   DEVICE FUEL COST                            LIQUID COST                 00001.74E-04
 DISPOSAL FACTOR SO2                         DISPOSAL FACTOR CO                          DISPOSAL FACTOR PART.
 DISPOSAL FACTOR -----*                      MFG PROCESS UNITS - 1 CHAR  T               COAL RATE SUMMER
 COAL RATE WINTER                            COAL RATE ANNIAL                            OIL RATE SUMMER
 OIL RATE WINTER                             OIL RATE ANNUAL                             GAS RATE SUMMER
 GAS RATE WINTER                             GAS RATE ANNUAL                             MATERIAL RATE SUMMER
 MATERIAL RATE WINTER                        MATERIAL RATE ANNUAL         01500.00E 00   EMISSION RATE SO2  SUMMER   00000.23E 00
 EMISSION RATE SO2  WINTER    00000.23E 00   EMISSION RATE SO2  ANNUAL    00000.23E 00   EMISSION RATE CO   SUMMER
 EMISSION RATE CO   WINTER                   EMISSION RATE CO   ANNUAL                   EMISSION RATE PART SUMMER   00000.27E 00
 EMISSION RATE PART WINTER    00000.27E 00   EMISSION RATE PART ANNUAL    00000.27E 00   EMISSION RATE  ------*
 EMISSION RATE  ------*                      EMISSION RATE  ------*
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                                         SOURCE FILE LISTING                                        MARCH 13, 1970

   REGION   INSTALLATION TEST CASE           SOURCE ID  33230710            DESCRIPTIVE NAME  STEEL FOUNDRY-BOILER

 LOCATION X                 00089.60E 00    LOCATION Y              00073.90E 00    AREA
 LINE X                                     LINE Y                                  POLITICAL JURISDICTION      02
 OWNERSHIP - 1 CHAR.          P             SOURCE TYPE - 1 CHAR.        B          STACK HEIGHT LIMIT
 STACK HEIGHT               00031.00E 00    STACK DIAMETER          00002.10E 00    EXIT VELOCITY             00015.20E 00
 EXIT TEMPERATURE           00505.00E 00    EXISTING CONTROL DEVICE                 EXISTING SO2 CONTROL EFF.
 EXISTING CO  CONTROL EFF.                  EXISTING PART. CONTROL EFF.             EXISTING ------* CONTR EFF.  00000.00E 00
 EXHAUST GAS VOLUME         00119.00E 03    RATED CAPACITY          02269.60E 06    OPERATING TIME            08760.00E 00
 SUMMER SHIFTS                              WINTER SHIFTS                           ANNUAL SHIFTS             00003.00E 00
 ORIGINAL COAL COST                         ORIGINAL OIL  COST      00006.90E-02    ORIGINAL GAS  COST        00005.50E-04
 ORIG  COAL HEAT   CONTENT                  ORIG  OIL  HEAT  CONTENT  00001.52E 05  ORIG  GAS  HEAT  CONTENT  00001.00E 03
 ORIG  COAL SULFUR CONTENT  00000.00E 00    ORIG  OIL  SULFUR CONTENT 00002.80E 00  ORIG  GAS  SULFUR CONTENT
 ELECTRICITY COST           00001.60E-02    DEVICE FUEL COST                        LIQUID COST               00001.74E-04
 DISPOSAL FACTOR SO2                        DISPOSAL FACTOR CO                      DISPOSAL FACTOR PART.
 DISPOSAL FACTOR -----*                     MFG PROCESS UNITS - 1 CHAR              COAL RATE SUMMER
 COAL RATE WINTER                           COAL RATE ANNUAL                        OIL RATE SUMMER
 OIL RATE WINTER                            OIL RATE ANNUAL         00345.00E 03    GAS RATE SUMMER
 GAS RATE WINTER                            GAS RATE ANNUAL         00002.15E 06    MATERIAL RATE SUMMER
 MATERIAL RATE WINTER                       MATERIAL RATE ANNUAL                    EMISSION RATE SO2  SUMMER 00006.19E 00
 EMISSION RATE SO2  WINTER  00006.19E 00    EMISSION RATE SO2  ANNUAL  00006.19E 00 EMISSION RATE CO   SUMMER
 EMISSION RATE CO   WINTER                  EMISSION RATE CO   ANNUAL               EMISSION RATE PART SUMMER 00000.59E 00
 EMISSION RATE PART WINTER  00000.59E 00    EMISSION RATE PART ANNUAL  00000.59E 00 EMISSION RATE  ------*
 EMISSION RATE  ------*                     EMISSION RATE  ------*
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                                   SOURCE FILE LISTING                                        MARCH 13, 1978

  I    REGION   INSTALLATION TEST CASE         SOURCE ID  33230721           DESCRIPTIVE NAME  STEEL FOUNDRY          I
    LOCATION X                   00089.80E 00   LOCATION Y                   00074.50E 00   AREA
    LINE X                                      LINE Y                                      POLITICAL JURISDICTION    02
    OWNERSHIP - 1 CHAR.          P              SOURCE TYPE - 1 CHAR.        P              STACK HEIGHT LIMIT
    STACK HEIGHT                 00030.00E 00   STACK DIAMETER               00000.46E 00   EXIT VELOCITY                 00017.80E 00
    EXIT TEMPERATURE             00450.00E 00   EXISTING CONTROL DEVICE                     EXISTING SO2 CONTROL EFF.
    EXISTING CO  CONTROL EFF.                   EXISTING PART. CONTROL EFF.                 EXISTING -----* CONTR EFF.,   00000.00E 00
    EXHAUST GAS VOLUME           06200.00E 00   RATED CAPACITY                              OPERATING TIME                08760.00E 00
    SUMMER SHIFTS                               WINTER SHIFTS                               ANNUAL SHIFTS                 00003.00E 00
    ORIGINAL COAL COST                          ORIGINAL OIL  COST                          ORIGINAL GAS  COST
    ORIG  COAL HEAT   CONTENT                   ORIG  OIL  HEAT   CONTENT                   ORIG  GAS  HEAT  .CONTENT
    ORIG  COAL SULFUR CONTENT                   ORIG  OIL  SULFUR CONTENT                   ORIG  GAS  SULFUR CONTENT
    ELECTRICITY COST             00002.11E-02   DEVICE FUEL COST                            LIQUID COST                   00001.74E-04
    DISPOSAL FACTOR SO2                         DISPOSAL FACTOR CO                          DISPOSAL FACTOR PART.
    DISPOSAL FACTOR ------*                     MFG PROCESS UNITS - 1 CHAR  T               COAL RATE SUMMER
    COAL RATE WINTER                            COAL RATE ANNUAL                            OIL RATE SUMMER
    OIL RATE WINTER                             OIL RATE ANNUAL                             GAS RATE SUMMER
    GAS RATE WINTER                             GAS RATE ANNUAL                             MATERIAL RATE SUMMER
    MATERIAL RATE WINTER                        MATERIAL RATE ANNUAL         00013.70E 00   EMISSION RATE SO2  SUMMER     00000.92E 00
    EMISSION RATE SO2  WINTER    00000.92E 00   EMISSION RATE SO2  ANNUAL    00000.92E 00   EMISSION RATE CO   SUMMER
    EMISSION RATE CO   WINTER                   EMISSION RATE CO   ANNUAL                   EMISSION RATE PART SUMMER     00001.01E 00
    EMISSION RATE PART WINTER    00001.01E 00   EMISSION RATE PART ANNUAL    00001.01E 00   EMISSION RATE  ------*
    EMISSION RATE  ------*                      EMISSION RATE  ------*
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                                        SOURCE FILE LISTING                                          MARCH 13, 1976

  REGION   INSTALLATION TEST CASE          SOURCE ID  31322701          DESCRIPTIVE NAME  [illegible]

LOCATION X                  00071.60E 00   LOCATION Y                  00026.40E 00   AREA
LINE X                                     LINE Y                                     POLITICAL JURISDICTION       01
OWNERSHIP - 1 CHAR.         P              SOURCE TYPE - 1 CHAR.       P              STACK HEIGHT LIMIT
STACK HEIGHT                00030.00E 00   STACK DIAMETER              00003.22E 00   EXIT VELOCITY                00017.[illegible] 00
EXIT TEMPERATURE            00782.00E 00   EXISTING CONTROL DEVICE     016            EXISTING SO2 CONTROL EFF.
EXISTING CO  CONTROL EFF.                  EXISTING PART. CONTROL EFF. 00099.00E 00   EXISTING -----* CONTR EFF.   000[illegible]
EXHAUST GAS VOLUME          00302.00E 03   RATED CAPACITY                             OPERATING TIME               08760.00E 00
SUMMER SHIFTS                              WINTER SHIFTS                              ANNUAL SHIFTS                00003.00E 00
ORIGINAL COAL COST                         ORIGINAL OIL  COST                         ORIGINAL GAS  COST
ORIG  COAL HEAT   CONTENT                  ORIG  OIL  HEAT  CONTENT                   ORIG  GAS  HEAT  CONTENT
ORIG  COAL SULFUR CONTENT                  ORIG  OIL  SULFUR CONTENT                  ORIG  GAS  SULFUR CONTENT
ELECTRICITY COST            00001.57E-02   DEVICE FUEL COST                           LIQUID COST                  00001.74E-02
DISPOSAL FACTOR SO2                        DISPOSAL FACTOR CO                         DISPOSAL FACTOR PART.
DISPOSAL FACTOR -----*                     MFG PROCESS UNITS - 1 CHAR  T              COAL RATE SUMMER
COAL RATE WINTER                           COAL RATE ANNUAL                           OIL RATE SUMMER
OIL RATE WINTER                            OIL RATE ANNUAL                            GAS RATE SUMMER
GAS RATE WINTER                            GAS RATE ANNUAL                            MATERIAL RATE SUMMER
MATERIAL RATE WINTER                       MATERIAL RATE ANNUAL        01150.00E 00   EMISSION RATE SO2  SUMMER    00203.00E 00
EMISSION RATE SO2  WINTER   00203.00E 00   EMISSION RATE SO2  ANNUAL   00203.00E 00   EMISSION RATE CO   SUMMER    00000.00E 00
EMISSION RATE CO   WINTER   00000.00E 00   EMISSION RATE CO   ANNUAL                  EMISSION RATE PART SUMMER    00000.31E 00
EMISSION RATE PART WINTER   00000.31E 00   EMISSION RATE PART ANNUAL   00000.31E 00   EMISSION RATE  ------*
EMISSION RATE  ------*                     EMISSION RATE  ------*
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                               SOURCE FILE LISTING                                        MARCH 13, 1978

   REGION   INSTALLATION TEST CASE          SOURCE ID  33322703         DESCRIPTIVE NAME  LEAD SMELTER-[illegible]

LOCATION X              00071.80E 00   LOCATION Y               00026.40E 00   AREA
LINE X                                 LINE Y                                  POLITICAL JURISDICTION        01
OWNERSHIP - 1 CHAR.           P        SOURCE TYPE - 1 CHAR.        P          STACK HEIGHT LIMIT
STACK HEIGHT            00030.00E 00   STACK DIAMETER           00000.74E 00   EXIT VELOCITY                00017.00E 00
EXIT TEMPERATURE        00783.00E 00   EXISTING CONTROL DEVICE    016          EXISTING SO2 CONTROL EFF.
EXISTING CO  CONTROL EFF.              EXISTING PART. CONTROL EFF.  00099.00E 00  EXISTING ------* CONTR EFF.,  00000.00E 00
EXHAUST GAS VOLUME      00016.00E 03   RATED CAPACITY                          OPERATING TIME               08760.00E 00
SUMMER SHIFTS                          WINTER SHIFTS                           ANNUAL SHIFTS                00003.00E 00
ORIGINAL COAL COST                     ORIGINAL OIL  COST                      ORIGINAL GAS  COST
ORIG  COAL HEAT   CONTENT              ORIG  OIL  HEAT   CONTENT               ORIG  GAS  HEAT   CONTENT
ORIG  COAL SULFUR CONTENT              ORIG  OIL  SULFUR CONTENT               ORIG  GAS  SULFUR CONTENT
ELECTRICITY COST        00001.57E-02   DEVICE FUEL COST                        LIQUID COST                  00001.74E-04
DISPOSAL FACTOR SO2                    DISPOSAL FACTOR CO                      DISPOSAL FACTOR PART.
DISPOSAL FACTOR ------*                MFG PROCESS UNITS - 1 CHAR  T           COAL RATE SUMMER
COAL RATE WINTER                       COAL RATE ANNUAL                        OIL RATE SUMMER
OIL RATE WINTER                        OIL RATE ANNUAL                         GAS RATE SUMMER
GAS RATE WINTER                        GAS RATE ANNUAL                         MATERIAL RATE SUMMER
MATERIAL RATE WINTER                   MATERIAL RATE ANNUAL     00530.00E 00   EMISSION RATE SO2  SUMMER    00028.20E 00
EMISSION RATE SO2  WINTER  00028.20E 00  EMISSION RATE SO2  ANNUAL  00028.20E 00  EMISSION RATE CO   SUMMER
EMISSION RATE CO   WINTER              EMISSION RATE CO   ANNUAL               EMISSION RATE PART SUMMER    00000.02E 00
EMISSION RATE PART WINTER  00000.02E 00  EMISSION RATE PART ANNUAL  00000.02E 00  EMISSION RATE  ------*
EMISSION RATE  ------*                 EMISSION RATE  ------*
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                                         SOURCE FILE LISTING                                MARCH 13, 1970

   REGION   INSTALLATION TEST CASE          SOURCE ID  37422800         DESCRIPTIVE NAME  RAILROAD CAR HPG-BOILER

 LOCATION X                 00084.40E 00    LOCATION Y                 00075.80E 00    AREA
 LINE X                                     LINE Y                                     POLITICAL JURISDICTION     01
 OWNERSHIP - 1 CHAR.        P               SOURCE TYPE - 1 CHAR.      B               STACK HEIGHT LIMIT
 STACK HEIGHT               00023.00E 00    STACK DIAMETER             00000.80E 00    EXIT VELOCITY              00015.38E 00
 EXIT TEMPERATURE           00564.00E 00    EXISTING CONTROL DEVICE    006             EXISTING SO2 CONTROL EFF.
 EXISTING CO  CONTROL EFF.                  EXISTING PART. CONTROL EFF. 00040.20E 00   EXISTING ------* CONTR EFF.,  00000.00E 00
 EXHAUST GAS VOLUME         00016.10E 03    RATED CAPACITY             00051.20E 06    OPERATING TIME             05840.00E 00
 SUMMER SHIFTS                              WINTER SHIFTS                              ANNUAL SHIFTS              00002.00E 00
 ORIGINAL COAL COST         00006.59E 00    ORIGINAL OIL  COST                         ORIGINAL GAS  COST
 ORIG  COAL HEAT   CONTENT  00023.00E 06    ORIG  OIL  HEAT   CONTENT                  ORIG  GAS  HEAT   CONTENT
 ORIG  COAL SULFUR CONTENT  00002.90E 00    ORIG  OIL  SULFUR CONTENT                  ORIG  GAS  SULFUR CONTENT
 ELECTRICITY COST           00002.11E-02    DEVICE FUEL COST                           LIQUID COST                00001.74E-04
 DISPOSAL FACTOR SO2                        DISPOSAL FACTOR CO                         DISPOSAL FACTOR PART.
 DISPOSAL FACTOR ------*                    HPG PROCESS UNITS - 1 CHAR                 COAL RATE SUMMER
 COAL RATE WINTER                           COAL RATE ANNUAL           00028.10E 00    OIL RATE SUMMER
 OIL RATE WINTER                            OIL RATE ANNUAL                            GAS RATE SUMMER
 GAS RATE WINTER                            GAS RATE ANNUAL                            MATERIAL RATE SUMMER
 MATERIAL RATE WINTER                       MATERIAL RATE ANNUAL                       EMISSION RATE SO2  SUMMER  00001.38E 00
 EMISSION RATE SO2  WINTER  00002.02E 00    EMISSION RATE SO2  ANNUAL  00001.60E 00    EMISSION RATE CO   SUMMER
 EMISSION RATE CO   WINTER                  EMISSION RATE CO   ANNUAL                  EMISSION RATE PART SUMMER  00000.98E 00
 EMISSION RATE PART WINTER  00001.54E 00    EMISSION RATE PART ANNUAL  00001.22E 00    EMISSION RATE  ------*
 EMISSION RATE  ------*                     EMISSION RATE  ------*
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                                         SOURCE FILE LISTING                                       MARCH 13, 1978

    REGION   INSTALLATION TEST CASE          SOURCE ID  49170050             DESCRIPTIVE NAME  POWER PLANT  [illegible]

  LOCATION X                    00075.20E 00   LOCATION Y                    00099.00E 00   AREA
  LINE X                                       LINE Y                                       POLITICAL JURISDICTION      1
  OWNERSHIP - 1 CHAR.           U              SOURCE TYPE - 1 CHAR.         B              STACK HEIGHT LIMIT
  STACK HEIGHT                  00121.00E 00   STACK DIAMETER                00006.72E 00   EXIT VELOCITY                 00015.20E 00
  EXIT TEMPERATURE              00439.00E 00   EXISTING CONTROL DEVICE       10             EXISTING SO2 CONTROL EFF.
  EXISTING CO  CONTROL EFF.                    EXISTING PART. CONTROL EFF.   00099.20E 00   EXISTING ------* CONTR EFF.   00000.00E 00
  EXHAUST GAS VOLUME            01128.00E 03   RATED CAPACITY                04810.00E 06   OPERATING TIME                08760.00E 00
  SUMMER SHIFTS                                WINTER SHIFTS                                ANNUAL SHIFTS                 00003.00E 00
  ORIGINAL COAL COST            00004.45E 00   ORIGINAL OIL  COST                           ORIGINAL GAS  COST
  ORIG  COAL HEAT   CONTENT     00023.00E 06   ORIG  OIL  HEAT   CONTENT                    ORIG  GAS  HEAT   CONTENT
  ORIG  COAL SULFUR CONTENT     00002.90E 00   ORIG  OIL  SULFUR CONTENT                    ORIG  GAS  SULFUR CONTENT
  ELECTRICITY COST              00001.57E-02   DEVICE FUEL COST                             LIQUID COST                   00001.74E-04
  DISPOSAL FACTOR SO2                          DISPOSAL FACTOR CO                           DISPOSAL FACTOR PART.
  DISPOSAL FACTOR ------*                      MFG PROCESS UNITS - 1 CHAR                   COAL RATE SUMMER
  COAL RATE WINTER                             COAL RATE ANNUAL              03369.90E 00   OIL RATE SUMMER
  OIL RATE WINTER                              OIL RATE ANNUAL                              GAS RATE SUMMER
  GAS RATE WINTER                              GAS RATE ANNUAL                              MATERIAL RATE SUMMER
  MATERIAL RATE WINTER                         MATERIAL RATE ANNUAL                         EMISSION RATE SO2  SUMMER     00192.08E 00
  EMISSION RATE SO2  WINTER     00192.08E 00   EMISSION RATE SO2  ANNUAL     00192.08E 00   EMISSION RATE CO   SUMMER
  EMISSION RATE CO   WINTER                    EMISSION RATE CO   ANNUAL                    EMISSION RATE PART SUMMER     00001.97E 00
  EMISSION RATE PART WINTER     00001.97E 00   EMISSION RATE PART ANNUAL     00001.97E 00   EMISSION RATE  ------*
  EMISSION RATE  ------*                       EMISSION RATE  ------*
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                                   SOURCE FILE LISTING                                        [illegible] 12, 197[illegible]

  REGION  INSTALLATION TEST CASE        SOURCE ID  45110060            DESCRIPTIVE NAME  POWER PLANT [illegible]

LOCATION X                  00130.00E 00   LOCATION Y                  00004.50E 00   AREA
LINE X                                     LINE Y                                     POLITICAL JURISDICTION        02
OWNERSHIP - 1 CHAR.         U              SOURCE TYPE - 1 CHAR.       B              STACK HEIGHT LIMIT
STACK HEIGHT                00121.00E 00   STACK DIAMETER              00000.92E 00   EXIT VELOCITY          00015.20E 00
EXIT TEMPERATURE            00449.00E 00   EXISTING CONTROL DEVICE                    EXISTING SO2 CONTROL EFF.
EXISTING CO  CONTROL EFF.                  EXISTING PART. CONTROL EFF.                EXISTING -----* CONTR EFF.,  00000.00E 00
EXHAUST GAS VOLUME          00021.10E 03   RATED CAPACITY              00481.00E 06   OPERATING TIME         08760.00E 00
SUMMER SHIFTS                              WINTER SHIFTS                              ANNUAL SHIFTS          00003.00E 00
ORIGINAL COAL COST          00004.45E 00   ORIGINAL OIL  COST                         ORIGINAL GAS  COST
ORIG  COAL  HEAT  CONTENT   00023.00E 06   ORIG  OIL  HEAT  CONTENT                   ORIG  GAS  HEAT  CONTENT
ORIG  COAL SULFUR CONTENT   00002.90E 00   ORIG  OIL  SULFUR CONTENT                  ORIG  GAS  SULFUR CONTENT
ELECTRICITY COST            00001.57E-02   DEVICE FUEL COST                           LIQUID COST            00001.74E-04
DISPOSAL FACTOR SO2                        DISPOSAL FACTOR CO                         DISPOSAL FACTOR PART.
DISPOSAL FACTOR -----*                     MFG PROCESS UNITS - 1 CHAR                 COAL RATE SUMMER
COAL RATE WINTER                           COAL RATE ANNUAL            00063.00E 00   OIL RATE SUMMER
OIL RATE WINTER                            OIL RATE ANNUAL                            GAS RATE SUMMER
GAS RATE WINTER                            GAS RATE ANNUAL                            MATERIAL RATE SUMMER
MATERIAL RATE WINTER                       MATERIAL RATE ANNUAL                       EMISSION RATE SO2  SUMMER   00003.59E 00
EMISSION RATE SO2  WINTER   00003.59E 00   EMISSION RATE SO2  ANNUAL   00003.59E 00   EMISSION RATE CO   SUMMER
EMISSION RATE CO   WINTER                  EMISSION RATE CO   ANNUAL                  EMISSION RATE PART SUMMER   00004.58E 00
EMISSION RATE PART WINTER   00004.58E 00   EMISSION RATE PART ANNUAL   00004.58E 00   EMISSION RATE  ------*
EMISSION RATE  ------*                     EMISSION RATE  ------*
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                                              SOURCE FILE LISTING                                          MARCH 13, 1979

   REGION   INSTALLATION TEST CASE          SOURCE ID  89110070           DESCRIPTIVE NAME  POWER PLANT 923 HE

 LOCATION X                 00076.90E 00    LOCATION Y                  00004.10E 00    AREA
 LINE X                                     LINE Y                                      POLITICAL JURISDICTION      02
 OWNERSHIP - 1 CHAR.        U               SOURCE TYPE - 1 CHAR.       B               STACK HEIGHT LIMIT
 STACK HEIGHT               00121.00E 00    STACK DIAMETER              00010.30E 00    EXIT VELOCITY                00015.20E 00
 EXIT TEMPERATURE           00427.00E 00    EXISTING CONTROL DEVICE     010             EXISTING SO2 CONTROL EFF.
 EXISTING CO  CONTROL EFF.                  EXISTING PART. CONTROL EFF. 00097.50E 00    EXISTING ------* CONTR EFF.  00000.00E 00
 EXHAUST GAS VOLUME         00002.64E 06    RATED CAPACITY              08075.00E 06    OPERATING TIME               08760.00E 00
 SUMMER SHIFTS                              WINTER SHIFTS                               ANNUAL SHIFTS                00003.00E 00
 ORIGINAL COAL COST         00004.45E 00    ORIGINAL OIL  COST                          ORIGINAL GAS  COST           00002.20E-04
 ORIG  COAL HEAT   CONTENT  00023.00E 06    ORIG  OIL  HEAT   CONTENT                   ORIG  GAS  HEAT   CONTENT    01000.00E 00
 ORIG  COAL SULFUR CONTENT  00002.90E 00    ORIG  OIL  SULFUR CONTENT                   ORIG  GAS  SULFUR CONTENT
 ELECTRICITY COST           00001.57E-02    DEVICE FUEL COST                            LIQUID COST                  00001.74E-04
 DISPOSAL FACTOR SO2                        DISPOSAL FACTOR CO                          DISPOSAL FACTOR PART.
 DISPOSAL FACTOR ------*                    MFG PROCESS UNITS - 1 CHAR                  COAL RATE SUMMER
 COAL RATE WINTER                           COAL RATE ANNUAL            06616.40E 00    OIL RATE SUMMER
 OIL RATE WINTER                            OIL RATE ANNUAL                             GAS RATE SUMMER
 GAS RATE WINTER                            GAS RATE ANNUAL             00006.30E 06    MATERIAL RATE SUMMER
 MATERIAL RATE WINTER                       MATERIAL RATE ANNUAL                        EMISSION RATE SO2  SUMMER    00419.00E 00
 EMISSION RATE SO2  WINTER  00382.40E 00    EMISSION RATE SO2  ANNUAL   00377.20E 00    EMISSION RATE CO   SUMMER
 EMISSION RATE CO   WINTER                  EMISSION RATE CO   ANNUAL                   EMISSION RATE PART SUMMER    00013.95E 00
 EMISSION RATE PART WINTER  00012.25E 00    EMISSION RATE PART ANNUAL   00012.09E 00    EMISSION RATE  ------*
 EMISSION RATE  ------*                     EMISSION RATE  ------*
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                                          SOURCE FILE LISTING                                      MARCH 13, 1970

   REGION   INSTALLATION TEST CASE         SOURCE ID  49531301           DESCRIPTIVE NAME  INCINERATOR

LOCATION X               00086.80E 00   LOCATION Y               00072.00E 00   AREA
LINE X                                  LINE Y                                  POLITICAL JURISDICTION      01
OWNERSHIP - 1 CHAR.         L           SOURCE TYPE - 1 CHAR.       S           STACK HEIGHT LIMIT
STACK HEIGHT             00046.00E 00   STACK DIAMETER           00002.92E 00   EXIT VELOCITY               00015.70E 00
EXIT TEMPERATURE         00533.00E 00   EXISTING CONTROL DEVICE                 EXISTING SO2 CONTROL EFF.,
EXISTING CO  CONTROL EFF.               EXISTING PART. CONTROL EFF.             EXISTING -----* CONTR EFF.,  00000.00E 00
EXHAUST GAS VOLUME       00212.00E 03   RATED CAPACITY                          OPERATING TIME              08760.00E 00
SUMMER SHIFTS                           WINTER SHIFTS                           ANNUAL SHIFTS               00003.00E 00
ORIGINAL COAL COST                      ORIGINAL OIL  COST                      ORIGINAL GAS  COST
ORIG  COAL HEAT   CONTENT               ORIG  OIL  HEAT   CONTENT               ORIG  GAS  HEAT   CONTENT
ORIG  COAL SULFUR CONTENT               ORIG  OIL  SULFUR CONTENT               ORIG  GAS  SULFUR CONTENT
ELECTRICITY COST         00001.65E-02   DEVICE FUEL COST                        LIQUID COST                 00001.74E-04
DISPOSAL FACTOR SO2                     DISPOSAL FACTOR CO                      DISPOSAL FACTOR PART.
DISPOSAL FACTOR -----*                  MPG PROCESS UNITS - 1 CHAR  T           COAL RATE SUMMER
COAL RATE WINTER                        COAL RATE ANNUAL                        OIL RATE SUMMER
OIL RATE WINTER                         OIL RATE ANNUAL                         GAS RATE SUMMER
GAS RATE WINTER                         GAS RATE ANNUAL                         MATERIAL RATE SUMMER
MATERIAL RATE WINTER                    MATERIAL RATE ANNUAL     00305.00E 00   EMISSION RATE SO2  SUMMER   00000.30E 00
EMISSION RATE SO2  WINTER  00000.30E 00 EMISSION RATE SO2  ANNUAL  00000.30E 00 EMISSION RATE CO   SUMMER   00000.15E 00
EMISSION RATE CO   WINTER  00000.15E 00 EMISSION RATE CO   ANNUAL  00000.15E 00 EMISSION RATE PART SUMMER   00002.55E 00
EMISSION RATE PART WINTER  00002.55E 00 EMISSION RATE PART ANNUAL  00002.55E 00 EMISSION RATE  ------*
EMISSION RATE  ------*                  EMISSION RATE  ------*
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                                          SOURCE FILE LISTING                                       MARCH 13, 1979

   REGION   INSTALLATION TEST CASE          SOURCE ID  99990010            DESCRIPTIVE NAME  AREA SOURCE

LOCATION X                 00034.80E 00   LOCATION Y                00089.70E 00    AREA                       00707.98E 00
LINE X                                    LINE Y                                    POLITICAL JURISDICTION     01
OWNERSHIP - 1 CHAR.                       SOURCE TYPE - 1 CHAR.                     STACK HEIGHT LIMIT
STACK HEIGHT                              STACK DIAMETER                            EXIT VELOCITY
EXIT TEMPERATURE                          EXISTING CONTROL DEVICE                   EXISTING SO2 CONTROL EFF.
EXISTING CO  CONTROL EFF.                 EXISTING PART. CONTROL EFF.               EXISTING -----* CONTR EFF.
EXHAUST GAS VOLUME                        RATED CAPACITY                            OPERATING TIME
SUMMER SHIFTS                             WINTER SHIFTS                             ANNUAL SHIFTS
ORIGINAL COAL COST                        ORIGINAL OIL  COST                        ORIGINAL GAS  COST
ORIG  COAL HEAT   CONTENT                 ORIG  OIL  HEAT   CONTENT                 ORIG  GAS  HEAT   CONTENT
ORIG  COAL SULFUR CONTENT                 ORIG  OIL  SULFUR CONTENT                 ORIG  GAS  SULFUR CONTENT
ELECTRICITY COST                          DEVICE FUEL COST                          LIQUID COST
DISPOSAL FACTOR SO2                       DISPOSAL FACTOR CO                        DISPOSAL FACTOR PART.
DISPOSAL FACTOR -----*                    MFG PROCESS UNITS - 1 CHAR                COAL RATE SUMMER
COAL RATE WINTER                          COAL RATE ANNIAL                          OIL RATE SUMMER
OIL RATE WINTER                           OIL RATE ANNUAL                           GAS RATE SUMMER
GAS RATE WINTER                           GAS RATE ANNUAL                           MATERIAL RATE SUMMER
MATERIAL RATE WINTER                      MATERIAL RATE ANNUAL                      EMISSION RATE SO2  SUMMER
EMISSION RATE SO2  WINTER                 EMISSION RATE SO2  ANNUAL   00000.24E 00  EMISSION RATE CO   SUMMER
EMISSION RATE CO   WINTER                 EMISSION RATE CO   ANNUAL                 EMISSION RATE PART SUMMER
EMISSION RATE PART WINTER                 EMISSION RATE PART ANNUAL   00000.07E 00  EMISSION RATE  ------*
EMISSION RATE  ------*                    EMISSION RATE  ------*
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                                             SOURCE FILE LISTING                                        MARCH 13, 1970

   REGION   INSTALLATION TEST CASE              SOURCE ID  99990020               DESCRIPTIVE NAME  AREA SOURCE

LOCATION X                 00058.00E 00    LOCATION Y                 00089.70E 00    AREA                          00707.40E 00
LINE X                                     LINE Y                                     POLITICAL JURISDICTION      01
OWNERSHIP - 1 CHAR.                        SOURCE TYPE - 1 CHAR.                      STACK HEIGHT LIMIT
STACK HEIGHT                               STACK DIAMETER                             EXIT VELOCITY
EXIT TEMPERATURE                           EXISTING CONTROL DEVICE                    EXISTING SO2 CONTROL EFF.
EXISTING CO  CONTROL EFF.                  EXISTING PART. CONTROL EFF.                EXISTING -----* CONTR EFF.
EXHAUST GAS VOLUME                         RATED CAPACITY                             OPERATING TIME
SUMMER SHIFTS                              WINTER SHIFTS                              ANNUAL SHIFTS
ORIGINAL COAL COST                         ORIGINAL OIL  COST                         ORIGINAL GAS  COST
ORIG  COAL HEAT   CONTENT                  ORIG  OIL  HEAT   CONTENT                  ORIG  GAS  HEAT   CONTENT
ORIG  COAL SULFUR CONTENT                  ORIG  OIL  SULFUR CONTENT                  ORIG  GAS  SULFUR CONTENT
ELECTRICITY COST                           DEVICE FUEL COST                           LIQUID COST
DISPOSAL FACTOR SO2                        DISPOSAL FACTOR CO                         DISPOSAL FACTOR PART.
DISPOSAL FACTOR -----*                     MFG PROCESS UNITS - 1 CHAR                 COAL RATE SUMMER
COAL RATE WINTER                           COAL RATE ANNUAL                           OIL RATE SUMMER
OIL RATE WINTER                            OIL RATE ANNUAL                            GAS RATE SUMMER
GAS RATE WINTER                            GAS RATE ANNUAL                            MATERIAL RATE SUMMER
MATERIAL RATE WINTER                       MATERIAL RATE ANNUAL                       EMISSION RATE SO2  SUMMER
EMISSION RATE SO2  WINTER                  EMISSION RATE SO2  ANNUAL   00000.40E 00   EMISSION RATE CO   SUMMER
EMISSION RATE CO   WINTER                  EMISSION RATE CO   ANNUAL                  EMISSION RATE PART SUMMER
EMISSION RATE PART WINTER                  EMISSION RATE PART ANNUAL   00000.40E 00   EMISSION RATE  ------*
EMISSION RATE  ------*                     EMISSION RATE  ------*
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                                         SOURCE FILE LISTING                                   MARCH 13, 1970

   REGION   INSTALLATION TEST CASE          SOURCE ID  99990030             DESCRIPTIVE NAME  AREA SOURCE
LOCATION X                    00075.40E 00  LOCATION Y                  00097.00E 00  AREA                     00176.80E 00
LINE X                                      LINE Y                                    POLITICAL JURISDICTION     01
OWNERSHIP - 1 CHAR.                         SOURCE TYPE - 1 CHAR.                     STACK HEIGHT LIMIT
STACK HEIGHT                                STACK DIAMETER                            EXIT VELOCITY
EXIT TEMPERATURE                            EXISTING CONTROL DEVICE                   EXISTING SO2 CONTROL EFF.
EXISTING CO  CONTROL EFF.                   EXISTING PART. CONTROL EFF.               EXISTING -----* CONTR EFF.
EXHAUST GAS VOLUME                          RATED CAPACITY                            OPERATING TIME
SUMMER SHIFTS                               WINTER SHIFTS                             ANNUAL SHIFTS
ORIGINAL COAL COST                          ORIGINAL OIL  COST                        ORIGINAL GAS  COST
ORIG  COAL HEAT   CONTENT                   ORIG  OIL  HEAT   CONTENT                 ORIG  GAS  HEAT   CONTENT
ORIG  COAL SULFUR CONTENT                   ORIG  OIL  SULFUR CONTENT                 ORIG  GAS  SULFUR CONTENT
ELECTRICITY COST                            DEVICE FUEL COST                          LIQUID COST
DISPOSAL FACTOR SO2                         DISPOSAL FACTOR CO                        DISPOSAL FACTOR PART.
DISPOSAL FACTOR -----*                      MPG PROCESS UNITS - 1 CHAR                COAL RATE SUMMER
COAL RATE WINTER                            COAL RATE ANNIAL                          OIL RATE SUMMER
OIL RATE WINTER                             OIL RATE ANNUAL                           GAS RATE SUMMER
GAS RATE WINTER                             GAS RATE ANNUAL                           MATERIAL RATE SUMMER
MATERIAL RATE WINTER                        MATERIAL RATE ANNUAL                      EMISSION RATE SO2  SUMMER
EMISSION RATE SO2   WINTER                  EMISSION RATE SO2  ANNUAL   00000.11E 00  EMISSION RATE CO   SUMMER
EMISSION RATE CO    WINTER                  EMISSION RATE CO   ANNUAL                 EMISSION RATE PART SUMMER
EMISSION RATE PART WINTER                   EMISSION RATE PART ANNUAL   00000.05E 00  EMISSION RATE  ------*
EMISSION RATE  ------*                      EMISSION RATE  ------*
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                                        SOURCE FILE LISTING                                        MARCH 13, 1970

   REGION   INSTALLATION TEST CASE            SOURCE ID  99990090             DESCRIPTIVE NAME  AREA SOURCE

   LOCATION X                00087.00E 00   LOCATION Y               00097.00E 00   AREA                        00176.00E 00
   LINE X                                   LINE Y                                  POLITICAL JURISDICTION      02
   OWNERSHIP - 1 CHAR.                      SOURCE TYPE - 1 CHAR.                   STACK HEIGHT LIMIT
   STACK HEIGHT                             STACK DIAMETER                          EXIT VELOCITY
   EXIT TEMPERATURE                         EXISTING CONTROL DEVICE                 EXISTING SO2 CONTROL EFF.
   EXISTING CO  CONTROL EFF.                EXISTING PART. CONTROL EFF.             EXISTING -----* CONTR EFF.
   EXHAUST GAS VOLUME                       RATED CAPACITY                          OPERATING TIME
   SUMMER SHIFTS                            WINTER SHIFTS                           ANNUAL SHIFTS
   ORIGINAL COAL COST                       ORIGINAL OIL  COST                      ORIGINAL GAS  COST
   ORIG  COAL HEAT   CONTENT                ORIG  OIL  HEAT   CONTENT               ORIG  GAS  HEAT   CONTENT
   ORIG  COAL SULFUR CONTENT                ORIG  OIL  SULFUR CONTENT               ORIG  GAS  SULFUR CONTENT
   ELECTRICITY COST                         DEVICE FUEL COST                        LIQUID COST
   DISPOSAL FACTOR SO2                      DISPOSAL FACTOR CO                      DISPOSAL FACTOR PART.
   DISPOSAL FACTOR -----*                   MFG PROCESS UNITS - 1 CHAR              COAL RATE SUMMER
   COAL RATE WINTER                         COAL RATE ANNUAL                        OIL RATE SUMMER
   OIL RATE WINTER                          OIL RATE ANNUAL                         GAS RATE SUMMER
   GAS RATE WINTER                          GAS RATE ANNUAL                         MATERIAL RATE SUMMER
   MATERIAL RATE WINTER                     MATERIAL RATE ANNUAL                    EMISSION RATE SO2  SUMMER
   EMISSION RATE SO2  WINTER                EMISSION RATE SO2  ANNUAL   00001.30E 00   EMISSION RATE CO   SUMMER
   EMISSION RATE CO   WINTER                EMISSION RATE CO   ANNUAL                  EMISSION RATE PART SUMMER
   EMISSION RATE PART WINTER                EMISSION RATE PART ANNUAL   00000.40E 00   EMISSION RATE  ------*
   EMISSION RATE  ------*                   EMISSION RATE  ------*
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                                    SOURCE FILE LISTING                                        MARCH 13, 1970

      REGION   INSTALLATION TEST CASE          SOURCE ID  99990050           DESCRIPTIVE NAME  AREA SOURCE
LOCATION X                 00098.60E 00   LOCATION Y                00097.00E 00   AREA                      00176.80E 00
LINE X                                    LINE Y                                   POLITICAL JURISDICTION      02
OWNERSHIP - 1 CHAR.                       SOURCE TYPE - 1 CHAR.                    STACK HEIGHT LIMIT
STACK HEIGHT                              STACK DIAMETER                           EXIT VELOCITY
EXIT TEMPERATURE                          EXISTING CONTROL DEVICE                  EXISTING SO2 CONTROL EFF.
EXISTING CO  CONTROL EFF.                 EXISTING PART. CONTROL EFF.              EXISTING -----* CONTR EFF.
EXHAUST GAS VOLUME                        RATED CAPACITY                           OPERATING TIME
SUMMER SHIFTS                             WINTER SHIFTS                            ANNUAL SHIFTS
ORIGINAL COAL COST                        ORIGINAL OIL  COST                       ORIGINAL GAS  COST
ORIG  COAL HEAT   CONTENT                 ORIG  OIL  HEAT   CONTENT                ORIG  GAS  HEAT   CONTENT
ORIG  COAL SULFUR CONTENT                 ORIG  OIL  SULFUR CONTENT                ORIG  GAS  SULFUR CONTENT
ELECTRICITY COST                          DEVICE FUEL COST                         LIQUID COST
DISPOSAL FACTOR SO2                       DISPOSAL FACTOR CO                       DISPOSAL FACTOR PART.
DISPOSAL FACTOR -----*                    MFG PROCESS UNITS - 1 CHAR               COAL RATE SUMMER
COAL RATE WINTER                          COAL RATE ANNIAL                         OIL RATE SUMMER
OIL RATE WINTER                           OIL RATE ANNUAL                          GAS RATE SUMMER
GAS RATE WINTER                           GAS RATE ANNUAL                          MATERIAL RATE SUMMER
MATERIAL RATE WINTER                      MATERIAL RATE ANNUAL                     EMISSION RATE SO2  SUMMER
EMISSION RATE SO2  WINTER                 EMISSION RATE SO2  ANNUAL   00003.85E 00 EMISSION RATE CO   SUMMER
EMISSION RATE CO   WINTER                 EMISSION RATE CO   ANNUAL                EMISSION RATE PART SUMMER
EMISSION RATE PART WINTER                 EMISSION RATE PART ANNUAL   00000.81E 00 EMISSION RATE ------*
EMISSION RATE ------*                     EMISSION RATE ------*
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                                         SOURCE FILE LISTING                                              MARCH 13, 1978

   REGION   INSTALLATION TEST CASE            SOURCE ID  99990060             DESCRIPTIVE NAME  AREA SOURCE

 LOCATION X                   00110.20E 00    LOCATION Y                 00097.00E 00    AREA                          00176.00E 00
 LINE X                                       LINE Y                                     POLITICAL JURISDICTION       02
 OWNERSHIP - 1 CHAR.                          SOURCE TYPE - 1 CHAR.                      STACK HEIGHT LIMIT
 STACK HEIGHT                                 STACK DIAMETER                             EXIT VELOCITY
 EXIT TEMPERATURE                             EXISTING CONTROL DEVICE                    EXISTING SO2 CONTROL EFF.
 EXISTING CO  CONTROL EFF.                    EXISTING PART. CONTROL EFF.                EXISTING ------* CONTR EFF.
 EXHAUST GAS VOLUME                           RATED CAPACITY                             OPERATING TIME
 SUMMER SHIFTS                                WINTER SHIFTS                              ANNUAL SHIFTS
 ORIGINAL COAL COST                           ORIGINAL OIL  COST                         ORIGINAL GAS  COST
 ORIG  COAL HEAT   CONTENT                    ORIG  OIL  HEAT   CONTENT                  ORIG  GAS  HEAT  CONTENT
 ORIG  COAL SULFUR CONTENT                    ORIG  OIL  SULFUR CONTENT                  ORIG  GAS  SULFUR CONTENT
 ELECTRICITY COST                             DEVICE FUEL COST                           LIQUID COST
 DISPOSAL FACTOR SO2                          DISPOSAL FACTOR CO                         DISPOSAL FACTOR PART.
 DISPOSAL FACTOR ------*                      MFG PROCESS UNITS - 1 CHAR                 COAL RATE SUMMER
 COAL RATE WINTER                             COAL RATE ANNUAL                           OIL RATE SUMMER
 OIL RATE WINTER                              OIL RATE ANNUAL                            GAS RATE SUMMER
 GAS RATE WINTER                              GAS RATE ANNUAL                            MATERIAL RATE SUMMER
 MATERIAL RATE WINTER                         MATERIAL RATE ANNUAL                       EMISSION RATE SO2  SUMMER
 EMISSION RATE SO2  WINTER                    EMISSION RATE SO2  ANNUAL   00000.17E 00   EMISSION RATE CO   SUMMER
 EMISSION RATE CO   WINTER                    EMISSION RATE CO   ANNUAL                  EMISSION RATE PART SUMMER
 EMISSION RATE PART WINTER                    EMISSION RATE PART ANNUAL   00000.04E 00   EMISSION RATE  ------*
 EMISSION RATE  ------*                       EMISSION RATE  ------*
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                                        SOURCE FILE LISTING                                          MARCH 13, 1978

      REGION   INSTALLATION TEST CASE          SOURCE ID  99990070              DESCRIPTIVE NAME  AREA SOURCE

LOCATION X                  00127.60E 00   LOCATION Y                 00089.70E 00   AREA                       00707.48E 06
LINE X                                     LINE Y                                    POLITICAL JURISDICTION     02
OWNERSHIP - 1 CHAR.                        SOURCE TYPE - 1 CHAR.                     STACK HEIGHT LIMIT
STACK HEIGHT                               STACK DIAMETER                            EXIT VELOCITY
EXIT TEMPERATURE                           EXISTING CONTROL DEVICE                   EXISTING SO2 CONTROL EFF.
EXISTING CO  CONTROL EFF.                  EXISTING PART. CONTROL EFF.               EXISTING -----* CONTR EFF.
EXHAUST GAS VOLUME                         RATED CAPACITY                            OPERATING TIME
SUMMER SHIFTS                              WINTER SHIFTS                             ANNUAL SHIFTS
ORIGINAL COAL COST                         ORIGINAL OIL  COST                        ORIGINAL GAS  COST
ORIG  COAL HEAT   CONTENT                  ORIG  OIL  HEAT   CONTENT                 ORIG  GAS  HEAT   CONTENT
ORIG  COAL SULFUR CONTENT                  ORIG  OIL  SULFUR CONTENT                 ORIG  GAS  SULFUR CONTENT
ELECTRICITY COST                           DEVICE FUEL COST                          LIQUID COST
DISPOSAL FACTOR SO2                        DISPOSAL FACTOR CO                        DISPOSAL FACTOR PART.
DISPOSAL FACTOR -----*                     MFG PROCESS UNITS - 1 CHAR                COAL RATE SUMMER
COAL RATE WINTER                           COAL RATE ANNUAL                          OIL RATE SUMMER
OIL RATE WINTER                            OIL RATE ANNUAL                           GAS RATE SUMMER
GAS RATE WINTER                            GAS RATE ANNUAL                           MATERIAL RATE SUMMER
MATERIAL RATE WINTER                       MATERIAL RATE ANNUAL                      EMISSION RATE SO2  SUMMER
EMISSION RATE SO2  WINTER                  EMISSION RATE SO2  ANNUAL   00000.50E 00  EMISSION RATE CO   SUMMER
EMISSION RATE CO   WINTER                  EMISSION RATE CO   ANNUAL                 EMISSION RATE PART SUMMER
EMISSION RATE PART WINTER                  EMISSION RATE PART ANNUAL   00000.12E 00  EMISSION RATE  ------*
EMISSION RATE  ------*                     EMISSION RATE  ------*
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                                             SOURCE FILE LISTING                                        MARCH 13, 1970

    RESIDE   INSTALLATION TEST CASE          SOURCE ID  99990080              DESCRIPTIVE NAME  AREA SOURCE

LOCATION X                 00075.40E 00   LOCATION Y                  00082.40E 00   AREA                        00176.80E 00
LINE X                                    LINE Y                                     POLITICAL JURISDICTION   01
OWNERSHIP - 1 CHAR.                       SOURCE TYPE - 1 CHAR.                      STACK HEIGHT LIMIT
STACK HEIGHT                              STACK DIAMETER                             EXIT VELOCITY
EXIT TEMPERATURE                          EXISTING CONTROL DEVICE                    EXISTING SO2 CONTROL EFF.
EXISTING CO  CONTROL EFF.                 EXISTING PART. CONTROL EFF.                EXISTING ------* CONTR EFF.
EXHAUST GAS VOLUME                        RATED CAPACITY                             OPERATING TIME
SUMMER SHIFTS                             WINTER SHIFTS                              ANNUAL SHIFTS
ORIGINAL COAL COST                        ORIGINAL OIL  COST                         ORIGINAL GAS  COST
ORIG  COAL HEAT   CONTENT                 ORIG  OIL  HEAT   CONTENT                  ORIG  GAS  HEAT   CONTENT
ORIG  COAL SULFUR CONTENT                 ORIG  OIL  SULFUR CONTENT                  ORIG  GAS  SULFUR CONTENT
ELECTRICITY COST                          DEVICE FUEL COST                           LIQUID COST
DISPOSAL FACTOR SO2                       DISPOSAL FACTOR CO                         DISPOSAL FACTOR PART.
DISPOSAL FACTOR ------*                   MPG PROCESS UNITS - 1 CHAR                 COAL RATE SUMMER
COAL RATE WINTER                          COAL RATE ANNUAL                           OIL RATE SUMMER
OIL RATE WINTER                           OIL RATE ANNUAL                            GAS RATE SUMMER
GAS RATE WINTER                           GAS RATE ANNUAL                            MATERIAL RATE SUMMER
MATERIAL RATE WINTER                      MATERIAL RATE ANNUAL                       EMISSION RATE SO2  SUMMER
EMISSION RATE SO2  WINTER                 EMISSION RATE SO2  ANNUAL   00002.54E 00   EMISSION RATE CO   SUMMER
EMISSION RATE CO   WINTER                 EMISSION RATE CO   ANNUAL                  EMISSION RATE PART SUMMER
EMISSION RATE PART WINTER                 EMISSION RATE PART ANNUAL   00000.56E 00   EMISSION RATE  ------*
EMISSION RATE  ------*                    EMISSION RATE  ------*
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                                         SOURCE FILE LISTING                                     MARCH 13, 1970

   REGION   INSTALLATION TEST CASE          SOURCE ID  99990090           DESCRIPTIVE NAME  AREA SOURCE
 LOCATION X                  00087.00E 00   LOCATION Y                  00082.40E 00   AREA                       00176.80E 00
 LINE X                                     LINE Y                                     POLITICAL JURISDICTION    01
 OWNERSHIP - 1 CHAR.                        SOURCE TYPE - 1 CHAR.                      STACK HEIGHT LIMIT
 STACK HEIGHT                               STACK DIAMETER                             EXIT VELOCITY
 EXIT TEMPERATURE                           EXISTING CONTROL DEVICE                    EXISTING SO2 CONTROL EFF.
 EXISTING CO  CONTROL EFF.                  EXISTING PART. CONTROL EFF.                EXISTING ------* CONTR EFF.
 EXHAUST GAS VOLUME                         RATED CAPACITY                             OPERATING TIME
 SUMMER SHIFTS                              WINTER SHIFTS                              ANNUAL SHIFTS
 ORIGINAL COAL COST                         ORIGINAL OIL  COST                         ORIGINAL GAS  COST
 ORIG  COAL HEAT   CONTENT                  ORIG  OIL  HEAT   CONTENT                  ORIG  GAS  HEAT   CONTENT
 ORIG  COAL SULFUR CONTENT                  ORIG  OIL  SULFUR CONTENT                  ORIG  GAS  SULFUR CONTENT
 ELECTRICITY COST                           DEVICE FUEL COST                           LIQUID COST
 DISPOSAL FACTOR SO2                        DISPOSAL FACTOR CO                         DISPOSAL FACTOR PART.
 DISPOSAL FACTOR ------*                    MFG PROCESS UNITS - 1 CHAR                 COAL RATE SUMMER
 COAL RATE WINTER                           COAL RATE ANNUAL                           OIL RATE SUMMER
 OIL RATE WINTER                            OIL RATE ANNUAL                            GAS RATE SUMMER
 GAS RATE WINTER                            GAS RATE ANNUAL                            MATERIAL RATE SUMMER
 MATERIAL RATE WINTER                       MATERIAL RATE ANNUAL                       EMISSION RATE SO2  SUMMER
 EMISSION RATE SO2  WINTER                  EMISSION RATE SO2  ANNUAL    00003.00E 00  EMISSION RATE CO   SUMMER
 EMISSION RATE CO   WINTER                  EMISSION RATE CO   ANNUAL                  EMISSION RATE PART SUMMER
 EMISSION RATE PART WINTER                  EMISSION RATE PART ANNUAL    00000.76E 00  EMISSION RATE  ------*
 EMISSION RATE  ------*                     EMISSION RATE  ------*
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                                        SOURCE FILE LISTING                                          MARCH 13, 1970

    REGION   INSTALLATION TEST CASE           SOURCE ID  99990100              DESCRIPTIVE NAME  AREA SOURCE

 LOCATION X                 00098.60E 00   LOCATION Y                 00082.40E 00   AREA                      00176.00E 00
 LINE X                                    LINE Y                                    POLITICAL JURISDICTION     02
 OWNERSHIP - 1 CHAR.                       SOURCE TYPE - 1 CHAR.                     STACK HEIGHT LIMIT
 STACK HEIGHT                              STACK DIAMETER                            EXIT VELOCITY
 EXIT TEMPERATURE                          EXISTING CONTROL DEVICE                   EXISTING SO2 CONTROL EFF.
 EXISTING CO  CONTROL EFF.                 EXISTING PART. CONTROL EFF.               EXISTING ------* CONTR EFF.
 EXHAUST GAS VOLUME                        RATED CAPACITY                            OPERATING TIME
 SUMMER SHIFTS                             WINTER SHIFTS                             ANNUAL SHIFTS
 ORIGINAL COAL COST                        ORIGINAL OIL  COST                        ORIGINAL GAS  COST
 ORIG  COAL HEAT   CONTENT                 ORIG  OIL  HEAT   CONTENT                 ORIG  GAS  HEAT   CONTENT
 ORIG  COAL SULFUR CONTENT                 ORIG  OIL  SULFUR CONTENT                 ORIG  GAS  SULFUR CONTENT
 ELECTRICITY COST                          DEVICE FUEL COST                          LIQUID COST
 DISPOSAL FACTOR SO2                       DISPOSAL FACTOR CO                        DISPOSAL FACTOR PART.
 DISPOSAL FACTOR ------*                   MFG PROCESS UNITS - 1 CHAR                COAL RATE SUMMER
 COAL RATE WINTER                          COAL RATE ANNUAL                          OIL RATE SUMMER
 OIL RATE WINTER                           OIL RATE ANNUAL                           GAS RATE SUMMER
 GAS RATE WINTER                           GAS RATE ANNUAL                           MATERIAL RATE SUMMER
 MATERIAL RATE WINTER                      MATERIAL RATE ANNUAL                      EMISSION RATE SO2  SUMMER
 EMISSION RATE SO2  WINTER                 EMISSION RATE SO2  ANNUAL    00000.46E 00 EMISSION RATE CO   SUMMER
 EMISSION RATE CO   WINTER                 EMISSION RATE CO   ANNUAL                 EMISSION RATE PART SUMMER
 EMISSION RATE PART WINTER                 EMISSION RATE PART ANNUAL    00000.11E 00 EMISSION RATE  ------*
 EMISSION RATE  ------*                    EMISSION RATE  ------*
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                                        SOURCE FILE LISTING                                        MARCH 13, 1970

  REGION   INSTALLATION TEST CASE          SOURCE ID  99990110              DESCRIPTIVE NAME  AREA SOURCE

LOCATION X                    00110.20E 00    LOCATION Y                    00082.40E 00    AREA                          00176.80E 00
LINE X                                        LINE Y                                        POLITICAL JURISDICTION     02
OWNERSHIP - 1 CHAR.                           SOURCE TYPE - 1 CHAR.                         STACK HEIGHT LIMIT
STACK HEIGHT                                  STACK DIAMETER                                EXIT VELOCITY
EXIT TEMPERATURE                              EXISTING CONTROL DEVICE                       EXISTING SO2 CONTROL EFF.
EXISTING CO  CONTROL EFF.                     EXISTING PART. CONTROL EFF.                   EXISTING -----* CONTR EFF.
EXHAUST GAS VOLUME                            RATED CAPACITY                                OPERATING TIME
SUMMER SHIFTS                                 WINTER SHIFTS                                 ANNUAL SHIFTS
ORIGINAL COAL COST                            ORIGINAL OIL  COST                            ORIGINAL GAS  COST
ORIG  COAL HEAT   CONTENT                     ORIG  OIL  HEAT   CONTENT                     ORIG  GAS  HEAT   CONTENT
ORIG  COAL SULFUR CONTENT                     ORIG  OIL  SULFUR CONTENT                     ORIG  GAS  SULFUR CONTENT
ELECTRICITY COST                              DEVICE FUEL COST                              LIQUID COST
DISPOSAL FACTOR SO2                           DISPOSAL FACTOR CO                            DISPOSAL FACTOR PART.
DISPOSAL FACTOR -----*                        MFG PROCESS UNITS - 1 CHAR                    COAL RATE SUMMER
COAL RATE WINTER                              COAL RATE ANNUAL                              OIL RATE SUMMER
OIL RATE WINTER                               OIL RATE ANNUAL                               GAS RATE SUMMER
GAS RATE WINTER                               GAS RATE ANNUAL                               MATERIAL RATE SUMMER
MATERIAL RATE WINTER                          MATERIAL RATE ANNUAL                          EMISSION RATE SO2  SUMMER
EMISSION RATE SO2  WINTER                     EMISSION RATE SO2  ANNUAL    00000.00E 00     EMISSION RATE CO   SUMMER
EMISSION RATE CO   WINTER                     EMISSION RATE CO   ANNUAL                     EMISSION RATE PART SUMMER
EMISSION RATE PART WINTER                     EMISSION RATE PART ANNUAL    00000.00E 00     EMISSION RATE  ------*
EMISSION RATE  ------*                        EMISSION RATE  ------*
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                                          SOURCE FILE LISTING                                  MARCH 13, 1970

  REGION   INSTALLATION TEST CASE         SOURCE ID  99990120          DESCRIPTIVE NAME  AREA SOURCE

LOCATION X                 00011.60E 00   LOCATION Y             00060.50E 00   AREA                    00707.40E 00
LINE X                                    LINE Y                                POLITICAL JURISDICTION     01
OWNERSHIP - 1 CHAR.                       SOURCE TYPE - 1 CHAR.                 STACK HEIGHT LIMIT
STACK HEIGHT                              STACK DIAMETER                        EXIT VELOCITY
EXIT TEMPERATURE                          EXISTING CONTROL DEVICE               EXISTING SO2 CONTROL EFF.
EXISTING CO  CONTROL EFF.                 EXISTING PART. CONTROL EFF.           EXISTING -----* CONTR EFF.
EXHAUST GAS VOLUME                        RATED CAPACITY                        OPERATING TIME
SUMMER SHIFTS                             WINTER SHIFTS                         ANNUAL SHIFTS
ORIGINAL COAL COST                        ORIGINAL OIL  COST                    ORIGINAL GAS  COST
ORIG  COAL HEAT   CONTENT                 ORIG  OIL  HEAT   CONTENT             ORIG  GAS  HEAT   CONTENT
ORIG  COAL SULFUR CONTENT                 ORIG  OIL  SULFUR CONTENT             ORIG  GAS  SULFUR CONTENT
ELECTRICITY COST                          DEVICE FUEL COST                      LIQUID COST
DISPOSAL FACTOR SO2                       DISPOSAL FACTOR CO                    DISPOSAL FACTOR PART.
DISPOSAL FACTOR -----*                    MPG PROCESS UNITS - 1 CHAR            COAL RATE SUMMER
COAL RATE WINTER                          COAL RATE ANNUAL                      OIL RATE SUMMER
OIL RATE WINTER                           OIL RATE ANNUAL                       GAS RATE SUMMER
GAS RATE WINTER                           GAS RATE ANNUAL                       MATERIAL RATE SUMMER
MATERIAL RATE WINTER                      MATERIAL RATE ANNUAL                  EMISSION RATE SO2  SUMMER
EMISSION RATE SO2  WINTER                 EMISSION RATE SO2  ANNUAL   00000.01E 00   EMISSION RATE CO   SUMMER
EMISSION RATE CO   WINTER                 EMISSION RATE CO   ANNUAL             EMISSION RATE PART SUMMER
EMISSION RATE PART WINTER                 EMISSION RATE PART ANNUAL   00000.01E 00   EMISSION RATE  ------*
EMISSION RATE  ------*                    EMISSION RATE  ------*
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                                        SOURCE FILE LISTING                                        MARCH 13, 1970

     REGION   INSTALLATION TEST CASE            SOURCE ID  99990130               DESCRIPTIVE NAME  AREA SOURCE
  LOCATION X                   00034.80E 00     LOCATION Y                  00060.50E 00     AREA                        00707.40E 00
  LINE X                                        LINE Y                                       POLITICAL JURISDICTION     01
  OWNERSHIP - 1 CHAR.                           SOURCE TYPE - 1 CHAR.                        STACK HEIGHT LIMIT
  STACK HEIGHT                                  STACK DIAMETER                               EXIT VELOCITY
  EXIT TEMPERATURE                              EXISTING CONTROL DEVICE                      EXISTING SO2 CONTROL EFF.
  EXISTING CO  CONTROL EFF.                     EXISTING PART. CONTROL EFF.                  EXISTING -----* CONTR EFF.
  EXHAUST GAS VOLUME                            RATED CAPACITY                               OPERATING TIME
  SUMMER SHIFTS                                 WINTER SHIFTS                                ANNUAL SHIFTS
  ORIGINAL COAL COST                            ORIGINAL OIL  COST                           ORIGINAL GAS  COST
  ORIG  COAL HEAT   CONTENT                     ORIG  OIL  HEAT   CONTENT                    ORIG  GAS  HEAT  CONTENT
  ORIG  COAL SULFUR CONTENT                     ORIG  OIL  SULFUR CONTENT                    ORIG  GAS  SULFUR CONTENT
  ELECTRICITY COST                              DEVICE FUEL COST                             LIQUID COST
  DISPOSAL FACTOR SO2                           DISPOSAL FACTOR CO                           DISPOSAL FACTOR PART.
  DISPOSAL FACTOR -----*                        MFG PROCESS UNITS - 1 CHAR                   COAL RATE SUMMER
  COAL RATE WINTER                              COAL RATE ANNUAL                             OIL RATE SUMMER
  OIL RATE WINTER                               OIL RATE ANNUAL                              GAS RATE SUMMER
  GAS RATE WINTER                               GAS RATE ANNUAL                              MATERIAL RATE SUMMER
  MATERIAL RATE WINTER                          MATERIAL RATE ANNUAL                         EMISSION RATE SO2  SUMMER
  EMISSION RATE SO2  WINTER                     EMISSION RATE SO2  ANNUAL   00001.03E 00     EMISSION RATE CO   SUMMER
  EMISSION RATE CO   WINTER                     EMISSION RATE CO   ANNUAL                    EMISSION RATE PART SUMMER
  EMISSION RATE PART WINTER                     EMISSION RATE PART ANNUAL   00000.44E 00     EMISSION RATE  ------*
  EMISSION RATE  ------*                        EMISSION RATE  ------*
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                                                  SOURCE FILE LISTING                                                  MARCH 13, 1970

   REGION   INSTALLATION TEST CASE            SOURCE ID  99990140              DESCRIPTIVE NAME  AREA SOURCE

   LOCATION X                   00058.00E 00     LOCATION Y                    00060.50E 00      AREA                          00707.40E 00
   LINE X                                        LINE Y                                          POLITICAL JURISDICTION     01
   OWNERSHIP - 1 CHAR.                           SOURCE TYPE - 1 CHAR.                           STACK HEIGHT LIMIT
   STACK HEIGHT                                  STACK DIAMETER                                  EXIT VELOCITY
   EXIT TEMPERATURE                              EXISTING CONTROL DEVICE                         EXISTING SO2 CONTROL EFF.
   EXISTING CO  CONTROL EFF.                     EXISTING PART. CONTROL EFF.                     EXISTING -----* CONTR EFF.
   EXHAUST GAS VOLUME                            RATED CAPACITY                                  OPERATING TIME
   SUMMER SHIFTS                                 WINTER SHIFTS                                   ANNUAL SHIFTS
   ORIGINAL COAL COST                            ORIGINAL OIL  COST                              ORIGINAL GAS  COST
   ORIG  COAL HEAT   CONTENT                     ORIG  OIL  HEAT   CONTENT                       ORIG  GAS  HEAT   CONTENT
   ORIG  COAL SULFUR CONTENT                     ORIG  OIL  SULFUR CONTENT                       ORIG  GAS  SULFUR CONTENT
   ELECTRICITY COST                              DEVICE FUEL COST                                LIQUID COST
   DISPOSAL FACTOR SO2                           DISPOSAL FACTOR CO                              DISPOSAL FACTOR PART.
   DISPOSAL FACTOR -----*                        MFG PROCESS UNITS - 1 CHAR                      COAL RATE SUMMER
   COAL RATE WINTER                              COAL RATE ANNIAL                                OIL RATE SUMMER
   OIL RATE WINTER                               OIL RATE ANNUAL                                 GAS RATE SUMMER
   GAS RATE WINTER                               GAS RATE ANNUAL                                 MATERIAL RATE SUMMER
   MATERIAL RATE WINTER                          MATERIAL RATE ANNUAL                            EMISSION RATE SO2  SUMMER
   EMISSION RATE SO2  WINTER                     EMISSION RATE SO2  ANNUAL    00001.34E 00       EMISSION RATE CO   SUMMER
   EMISSION RATE CO   WINTER                     EMISSION RATE CO   ANNUAL                       EMISSION RATE PART SUMMER
   EMISSION RATE PART WINTER                     EMISSION RATE PART ANNUAL    00000.33E 00       EMISSION RATE  ------*
   EMISSION RATE  ------*                        EMISSION RATE  ------*
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                                        SOURCE FILE LISTING                                   MARCH 13, 1970

    REGION   INSTALLATION TEST CASE          SOURCE ID  99990150          DESCRIPTIVE NAME  AREA SOURCE
 LOCATION X                 00075.40E 00   LOCATION Y                 00067.80E 00   AREA                        00176.80E 00
 LINE X                                    LINE Y                                    POLITICAL JURISDICTION     01
 OWNERSHIP - 1 CHAR.                       SOURCE TYPE - 1 CHAR.                     STACK HEIGHT LIMIT
 STACK HEIGHT                              STACK DIAMETER                            EXIT VELOCITY
 EXIT TEMPERATURE                          EXISTING CONTROL DEVICE                   EXISTING SO2 CONTROL EFF.
 EXISTING CO  CONTROL EFF.                 EXISTING PART. CONTROL EFF.               EXISTING ------* CONTR EFF.
 EXHAUST GAS VOLUME                        RATED CAPACITY                            OPERATING TIME
 SUMMER SHIFTS                             WINTER SHIFTS                             ANNUAL SHIFTS
 ORIGINAL COAL COST                        ORIGINAL OIL  COST                        ORIGINAL GAS  COST
 ORIG  COAL HEAT   CONTENT                 ORIG  OIL  HEAT   CONTENT                 ORIG  GAS  HEAT   CONTENT
 ORIG  COAL SULFUR CONTENT                 ORIG  OIL  SULFUR CONTENT                 ORIG  GAS  SULFUR CONTENT
 ELECTRICITY COST                          DEVICE FUEL COST                          LIQUID COST
 DISPOSAL FACTOR SO2                       DISPOSAL FACTOR CO                        DISPOSAL FACTOR PART.
 DISPOSAL FACTOR -----*                    MFG PROCESS UNITS - 1 CHAR                COAL RATE SUMMER
 COAL RATE WINTER                          COAL RATE ANNUAL                          OIL RATE SUMMER
 OIL RATE WINTER                           OIL RATE ANNUAL                           GAS RATE SUMMER
 GAS RATE WINTER                           GAS RATE ANNUAL                           MATERIAL RATE SUMMER
 MATERIAL RATE WINTER                      MATERIAL RATE ANNUAL                      EMISSION RATE SO2  SUMMER
 EMISSION RATE SO2  WINTER                 EMISSION RATE SO2  ANNUAL   00016.48E 00  EMISSION RATE CO   SUMMER
 EMISSION RATE CO   WINTER                 EMISSION RATE CO   ANNUAL                 EMISSION RATE PART SUMMER
 EMISSION RATE PART WINTER                 EMISSION RATE PART ANNUAL   00003.96E 00  EMISSION RATE  ------*
 EMISSION RATE  ------*                    EMISSION RATE  ------*
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                                         SOURCE FILE LISTING                                              MARCH 13, 1970

   REGION   INSTALLATION TEST CASE               SOURCE ID  99990160                DESCRIPTIVE NAME  AREA SOURCE
 LOCATION X                00087.00E 00    LOCATION Y                    00067.80E 00     AREA                         00176.00E 00
 LINE X                                    LINE Y                                         POLITICAL JURISDICTION      01
 OWNERSHIP - 1 CHAR.                       SOURCE TYPE - 1 CHAR.                          STACK HEIGHT LIMIT
 STACK HEIGHT                              STACK DIAMETER                                 EXIT VELOCITY
 EXIT TEMPERATURE                          EXISTING CONTROL DEVICE                        EXISTING SO2 CONTROL EFF.
 EXISTING CO  CONTROL EFF.                 EXISTING PART. CONTROL EFF.                    EXISTING ------* CONTR EFF.
 EXHAUST GAS VOLUME                        RATED CAPACITY                                 OPERATING TIME
 SUMMER SHIFTS                             WINTER SHIFTS                                  ANNUAL SHIFTS
 ORIGINAL COAL COST                        ORIGINAL OIL  COST                             ORIGINAL GAS  COST
 ORIG  COAL HEAT   CONTENT                 ORIG  OIL  HEAT   CONTENT                      ORIG  GAS  HEAT   CONTENT
 ORIG  COAL SULFUR CONTENT                 ORIG  OIL  SULFUR CONTENT                      ORIG  GAS  SULFUR CONTENT
 ELECTRICITY COST                          DEVICE FUEL COST                               LIQUID COST
 DISPOSAL FACTOR SO2                       DISPOSAL FACTOR CO                             DISPOSAL FACTOR PART.
 DISPOSAL FACTOR ------*                   MFG PROCESS UNITS - 1 CHAR                     COAL RATE SUMMER
 COAL RATE WINTER                          COAL RATE ANNIAL                               OIL RATE SUMMER
 OIL RATE WINTER                           OIL RATE ANNUAL                                GAS RATE SUMMER
 GAS RATE WINTER                           GAS RATE ANNUAL                                MATERIAL RATE SUMMER
 MATERIAL RATE WINTER                      MATERIAL RATE ANNUAL                           EMISSION RATE SO2  SUMMER
 EMISSION RATE SO2  WINTER                 EMISSION RATE SO2  ANNUAL     00032.75E 00     EMISSION RATE CO   SUMMER
 EMISSION RATE CO   WINTER                 EMISSION RATE CO   ANNUAL                      EMISSION RATE PART SUMMER
 EMISSION RATE PART WINTER                 EMISSION RATE PART ANNUAL     00009.00E 00     EMISSION RATE  ------*
 EMISSION RATE  ------*                    EMISSION RATE  ------*
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                                   SOURCE FILE LISTING                                                       MARCH 13, 1970

       REGION   INSTALLATION TEST CASE           SOURCE ID  99990170              DESCRIPTIVE NAME  AREA SOURCE

  LOCATION X                  00098.60E 00    LOCATION Y                 00067.80E 00    AREA                      00176.80E 00
  LINE X                                      LINE Y                                     POLITICAL JURISDICTION    02
  OWNERSHIP - 1 CHAR.                         SOURCE TYPE - 1 CHAR.                      STACK HEIGHT LIMIT
  STACK HEIGHT                                STACK DIAMETER                             EXIT VELOCITY
  EXIT TEMPERATURE                            EXISTING CONTROL DEVICE                    EXISTING SO2 CONTROL EFF.
  EXISTING CO  CONTROL EFF.                   EXISTING PART. CONTROL EFF.                EXISTING -----* CONTR EFF.
  EXHAUST GAS VOLUME                          RATED CAPACITY                             OPERATING TIME
  SUMMER SHIFTS                               WINTER SHIFTS                              ANNUAL SHIFTS
  ORIGINAL COAL COST                          ORIGINAL OIL  COST                         ORIGINAL GAS  COST
  ORIG  COAL HEAT   CONTENT                   ORIG  OIL  HEAT   CONTENT                  ORIG  GAS  HEAT   CONTENT
  ORIG  COAL SULFUR CONTENT                   ORIG  OIL  SULFUR CONTENT                  ORIG  GAS  SULFUR CONTENT
  ELECTRICITY COST                            DEVICE FUEL COST                           LIQUID COST
  DISPOSAL FACTOR SO2                         DISPOSAL FACTOR CO                         DISPOSAL FACTOR PART.
  DISPOSAL FACTOR -----*                      MFG PROCESS UNITS - 1 CHAR                 COAL RATE SUMMER
  COAL RATE WINTER                            COAL RATE ANNIAL                           OIL RATE SUMMER
  OIL RATE WINTER                             OIL RATE ANNUAL                            GAS RATE SUMMER
  GAS RATE WINTER                             GAS RATE ANNUAL                            MATERIAL RATE SUMMER
  MATERIAL RATE WINTER                        MATERIAL RATE ANNUAL                       EMISSION RATE SO2  SUMMER
  EMISSION RATE SO2  WINTER                   EMISSION RATE SO2  ANNUAL    00008.60E 00  EMISSION RATE CO   SUMMER
  EMISSION RATE CO   WINTER                   EMISSION RATE CO   ANNUAL                  EMISSION RATE PART SUMMER
  EMISSION RATE PART WINTER                   EMISSION RATE PART ANNUAL    00002.16E 00  EMISSION RATE  ------*
  EMISSION RATE  ------*                      EMISSION RATE  ------*
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                                        SOURCE FILE LISTING                              MARCH 13, 1970

   REGION   INSTALLATION TEST CASE          SOURCE ID  99990180          DESCRIPTIVE NAME  AREA SOURCE

LOCATION X               00110.20E 00    LOCATION Y               00067.80E 00    AREA                    00176.80E 00
LINE X                                   LINE Y                                   POLITICAL JURISDICTION       02
OWNERSHIP - 1 CHAR.                      SOURCE TYPE - 1 CHAR.                    STACK HEIGHT LIMIT
STACK HEIGHT                             STACK DIAMETER                           EXIT VELOCITY
EXIT TEMPERATURE                         EXISTING CONTROL DEVICE                  EXISTING SO2 CONTROL EFF.
EXISTING CO  CONTROL EFF.                EXISTING PART. CONTROL EFF.              EXISTING -----* CONTR EFF.
EXHAUST GAS VOLUME                       RATED CAPACITY                           OPERATING TIME
SUMMER SHIFTS                            WINTER SHIFTS                            ANNUAL SHIFTS
ORIGINAL COAL COST                       ORIGINAL OIL  COST                       ORIGINAL GAS  COST
ORIG  COAL HEAT   CONTENT                ORIG  OIL  HEAT   CONTENT                ORIG  GAS  HEAT   CONTENT
ORIG  COAL SULFUR CONTENT                ORIG  OIL  SULFUR CONTENT                ORIG  GAS  SULFUR CONTENT
ELECTRICITY COST                         DEVICE FUEL COST                         LIQUID COST
DISPOSAL FACTOR SO2                      DISPOSAL FACTOR CO                       DISPOSAL FACTOR PART.
DISPOSAL FACTOR -----*                   MFG PROCESS UNITS - 1 CHAR               COAL RATE SUMMER
COAL RATE WINTER                         COAL RATE ANNUAL                         OIL RATE SUMMER
OIL RATE WINTER                          OIL RATE ANNUAL                          GAS RATE SUMMER
GAS RATE WINTER                          GAS RATE ANNUAL                          MATERIAL RATE SUMMER
MATERIAL RATE WINTER                     MATERIAL RATE ANNUAL                     EMISSION RATE SO2  SUMMER
EMISSION RATE SO2  WINTER                EMISSION RATE SO2  ANNUAL    00001.22E 00  EMISSION RATE CO   SUMMER
EMISSION RATE CO   WINTER                EMISSION RATE CO   ANNUAL                EMISSION RATE PART SUMMER
EMISSION RATE PART WINTER                EMISSION RATE PART ANNUAL    00000.22E 00  EMISSION RATE  ------*
EMISSION RATE  ------*                   EMISSION RATE  ------*
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                                        SOURCE FILE LISTING                                          MARCH 13, 1970

   REGION   INSTALLATION TEST CASE           SOURCE ID  99990190              DESCRIPTIVE NAME  AREA SOURCE

LOCATION X                  00127.60E 00   LOCATION Y                  00060.50E 00   AREA                       00707.40E 00
LINE X                                     LINE Y                                     POLITICAL JURISDICTION      02
OWNERSHIP - 1 CHAR.                        SOURCE TYPE - 1 CHAR.                      STACK HEIGHT LIMIT
STACK HEIGHT                               STACK DIAMETER                             EXIT VELOCITY
EXIT TEMPERATURE                           EXISTING CONTROL DEVICE                    EXISTING SO2 CONTROL EFF.
EXISTING CO  CONTROL EFF.                  EXISTING PART. CONTROL EFF.                EXISTING -----* CONTR EFF.
EXHAUST GAS VOLUME                         RATED CAPACITY                             OPERATING TIME
SUMMER SHIFTS                              WINTER SHIFTS                              ANNUAL SHIFTS
ORIGINAL COAL COST                         ORIGINAL OIL  COST                         ORIGINAL GAS  COST
ORIG  COAL HEAT   CONTENT                  ORIG  OIL  HEAT   CONTENT                  ORIG  GAS  HEAT   CONTENT
ORIG  COAL SULFUR CONTENT                  ORIG  OIL  SULFUR CONTENT                  ORIG  GAS  SULFUR CONTENT
ELECTRICITY COST                           DEVICE FUEL COST                           LIQUID COST
DISPOSAL FACTOR SO2                        DISPOSAL FACTOR CO                         DISPOSAL FACTOR PART.
DISPOSAL FACTOR -----*                     MPG PROCESS UNITS - 1 CHAR                 COAL RATE SUMMER
COAL RATE WINTER                           COAL RATE ANNUAL                           OIL RATE SUMMER
OIL RATE WINTER                            OIL RATE ANNUAL                            GAS RATE SUMMER
GAS RATE WINTER                            GAS RATE ANNUAL                            MATERIAL RATE SUMMER
MATERIAL RATE WINTER                       MATERIAL RATE ANNUAL                       EMISSION RATE SO2  SUMMER
EMISSION RATE SO2  WINTER                  EMISSION RATE SO2  ANNUAL   00000.78E 00   EMISSION RATE CO   SUMMER
EMISSION RATE CO   WINTER                  EMISSION RATE CO   ANNUAL                  EMISSION RATE PART SUMMER
EMISSION RATE PART WINTER                  EMISSION RATE PART ANNUAL   00000.15E 00   EMISSION RATE  ------*
EMISSION RATE  ------*                     EMISSION RATE  ------*
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                                        SOURCE FILE LISTING                                   MARCH 13, 1970

  |   REGION   INSTALLATION TEST CASE          SOURCE ID  99990200           DESCRIPTIVE NAME  AREA SOURCE     |
  LOCATION X                00075.40E 00   LOCATION Y                   00053.20E 00   AREA                      00176.80E 00
  LINE X                                   LINE Y                                      POLITICAL JURISDICTION    01
  OWNERSHIP - 1 CHAR.                      SOURCE TYPE - 1 CHAR.                       STACK HEIGHT LIMIT
  STACK HEIGHT                             STACK DIAMETER                              EXIT VELOCITY
  EXIT TEMPERATURE                         EXISTING CONTROL DEVICE                     EXISTING SO2 CONTROL EFF.
  EXISTING CO  CONTROL EFF.                EXISTING PART. CONTROL EFF.                 EXISTING -----* CONTR EFF.
  EXHAUST GAS VOLUME                       RATED CAPACITY                              OPERATING TIME
  SUMMER SHIFTS                            WINTER SHIFTS                               ANNUAL SHIFTS
  ORIGINAL COAL COST                       ORIGINAL OIL  COST                          ORIGINAL GAS  COST
  ORIG  COAL HEAT   CONTENT                ORIG  OIL  HEAT   CONTENT                   ORIG  GAS  HEAT   CONTENT
  ORIG  COAL SULFUR CONTENT                ORIG  OIL  SULFUR CONTENT                   ORIG  GAS  SULFUR CONTENT
  ELECTRICITY COST                         DEVICE FUEL COST                            LIQUID COST
  DISPOSAL FACTOR SO2                      DISPOSAL FACTOR CO                          DISPOSAL FACTOR PART.
  DISPOSAL FACTOR -----*                   MFG PROCESS UNITS - 1 CHAR                  COAL RATE SUMMER
  COAL RATE WINTER                         COAL RATE ANNIAL                            OIL RATE SUMMER
  OIL RATE WINTER                          OIL RATE ANNUAL                             GAS RATE SUMMER
  GAS RATE WINTER                          GAS RATE ANNUAL                             MATERIAL RATE SUMMER
  MATERIAL RATE WINTER                     MATERIAL RATE ANNUAL                        EMISSION RATE SO2  SUMMER
  EMISSION RATE SO2  WINTER                EMISSION RATE SO2  ANNUAL    00000.92E 00   EMISSION RATE CO   SUMMER
  EMISSION RATE CO   WINTER                EMISSION RATE CO   ANNUAL                   EMISSION RATE PART SUMMER
  EMISSION RATE PART WINTER                EMISSION RATE PART ANNUAL    00000.20E 00   EMISSION RATE  ------*
  EMISSION RATE  ------*                   EMISSION RATE  ------*
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                                          SOURCE FILE LISTING                                    MARCH 13, 1970

   REGION   INSTALLATION TEST CASE          SOURCE ID  99990210          DESCRIPTIVE NAME  AREA SOURCE

LOCATION X                 00087.00E 00  LOCATION Y               00053.20E 00  AREA                          00176.80E 00
LINE X                                   LINE Y                                 POLITICAL JURISDICTION      02
OWNERSHIP - 1 CHAR.                      SOURCE TYPE - 1 CHAR.                  STACK HEIGHT LIMIT
STACK HEIGHT                             STACK DIAMETER                         EXIT VELOCITY
EXIT TEMPERATURE                         EXISTING CONTROL DEVICE                EXISTING SO2 CONTROL EFF.
EXISTING CO  CONTROL EFF.                EXISTING PART. CONTROL EFF.            EXISTING -----* CONTR EFF.
EXHAUST GAS VOLUME                       RATED CAPACITY                         OPERATING TIME
SUMMER SHIFTS                            WINTER SHIFTS                          ANNUAL SHIFTS
ORIGINAL COAL COST                       ORIGINAL OIL  COST                     ORIGINAL GAS  COST
ORIG  COAL HEAT   CONTENT                ORIG  OIL  HEAT   CONTENT              ORIG  GAS  HEAT   CONTENT
ORIG  COAL SULFUR CONTENT                ORIG  OIL  SULFUR CONTENT              ORIG  GAS  SULFUR CONTENT
ELECTRICITY COST                         DEVICE FUEL COST                       LIQUID COST
DISPOSAL FACTOR SO2                      DISPOSAL FACTOR CO                     DISPOSAL FACTOR PART.
DISPOSAL FACTOR -----*                   BPG PROCESS UNITS - 1 CHAR             COAL RATE SUMMER
COAL RATE WINTER                         COAL RATE ANNIAL                       OIL RATE SUMMER
OIL RATE WINTER                          OIL RATE ANNUAL                        GAS RATE SUMMER
GAS RATE WINTER                          GAS RATE ANNUAL                        MATERIAL RATE SUMMER
MATERIAL RATE WINTER                     MATERIAL RATE ANNUAL                   EMISSION RATE SO2  SUMMER
EMISSION RATE SO2  WINTER                EMISSION RATE SO2  ANNUAL  00002.37E 00  EMISSION RATE CO   SUMMER
EMISSION RATE CO   WINTER                EMISSION RATE CO   ANNUAL              EMISSION RATE PART SUMMER
EMISSION RATE PART WINTER                EMISSION RATE PART ANNUAL  00002.02E 00  EMISSION RATE  ------*
EMISSION RATE  ------*                   EMISSION RATE  ------*
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                                     SOURCE FILE LISTING                              MARCH 13, 1970

  REGION   INSTALLATION TEST CASE        SOURCE ID  99990220          DESCRIPTIVE NAME  AREA SOURCE
LOCATION X              00098.60E 00   LOCATION Y              00053.20E 00   AREA                      00176.80E 00
LINE X                                 LINE Y                                 POLITICAL JURISDICTION      02
OWNERSHIP - 1 CHAR.                    SOURCE TYPE - 1 CHAR.                  STACK HEIGHT LIMIT
STACK HEIGHT                           STACK DIAMETER                         EXIT VELOCITY
EXIT TEMPERATURE                       EXISTING CONTROL DEVICE                EXISTING SO2 CONTROL EFF.
EXISTING CO  CONTROL EFF.              EXISTING PART. CONTROL EFF.            EXISTING -----* CONTR EFF.
EXHAUST GAS VOLUME                     RATED CAPACITY                         OPERATING TIME
SUMMER SHIFTS                          WINTER SHIFTS                          ANNUAL SHIFTS
ORIGINAL COAL COST                     ORIGINAL OIL  COST                     ORIGINAL GAS  COST
ORIG  COAL HEAT   CONTENT              ORIG  OIL  HEAT   CONTENT              ORIG  GAS  HEAT   CONTENT
ORIG  COAL SULFUR CONTENT              ORIG  OIL  SULFUR CONTENT              ORIG  GAS  SULFUR CONTENT
ELECTRICITY COST                       DEVICE FUEL COST                       LIQUID COST
DISPOSAL FACTOR SO2                    DISPOSAL FACTOR CO                     DISPOSAL FACTOR PART.
DISPOSAL FACTOR -----*                 BPG PROCESS UNITS - 1 CHAR             COAL RATE SUMMER
COAL RATE WINTER                       COAL RATE ANNUAL                       OIL RATE SUMMER
OIL RATE WINTER                        OIL RATE ANNUAL                        GAS RATE SUMMER
GAS RATE WINTER                        GAS RATE ANNUAL                        MATERIAL RATE SUMMER
MATERIAL RATE WINTER                   MATERIAL RATE ANNUAL                   EMISSION RATE SO2  SUMMER
EMISSION RATE SO2  WINTER              EMISSION RATE SO2  ANNUAL   00001.20E 00   EMISSION RATE CO   SUMMER
EMISSION RATE CO   WINTER              EMISSION RATE CO   ANNUAL              EMISSION RATE PART SUMMER
EMISSION RATE PART WINTER              EMISSION RATE PART ANNUAL   00000.69E 00   EMISSION RATE  ------*
EMISSION RATE  ------*                 EMISSION RATE  ------*
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                                        SOURCE FILE LISTING                                    MARCH 13, 1970

    REGION   INSTALLATION TEST CASE          SOURCE ID  99990230           DESCRIPTIVE NAME  AREA SOURCE

LOCATION X                    00110.20E 00   LOCATION Y                   00053.20E 00   AREA                      00176.80E 00
LINE X                                       LINE Y                                      POLITICAL JURISDICTION       02
OWNERSHIP - 1 CHAR.                          SOURCE TYPE - 1 CHAR.                       STACK HEIGHT LIMIT
STACK HEIGHT                                 STACK DIAMETER                              EXIT VELOCITY
EXIT TEMPERATURE                             EXISTING CONTROL DEVICE                     EXISTING SO2 CONTROL EFF.
EXISTING CO  CONTROL EFF.                    EXISTING PART. CONTROL EFF.                 EXISTING -----* CONTR EFF.
EXHAUST GAS VOLUME                           RATED CAPACITY                              OPERATING TIME
SUMMER SHIFTS                                WINTER SHIFTS                               ANNUAL SHIFTS
ORIGINAL COAL COST                           ORIGINAL OIL  COST                          ORIGINAL GAS  COST
ORIG  COAL HEAT   CONTENT                    ORIG  OIL  HEAT   CONTENT                   ORIG  GAS  HEAT   CONTENT
ORIG  COAL SULFUR CONTENT                    ORIG  OIL  SULFUR CONTENT                   ORIG  GAS  SULFUR CONTENT
ELECTRICITY COST                             DEVICE FUEL COST                            LIQUID COST
DISPOSAL FACTOR SO2                          DISPOSAL FACTOR CO                          DISPOSAL FACTOR PART.
DISPOSAL FACTOR -----*                       MFG PROCESS UNITS - 1 CHAR                  COAL RATE SUMMER
COAL RATE WINTER                             COAL RATE ANNUAL                            OIL RATE SUMMER
OIL RATE WINTER                              OIL RATE ANNUAL                             GAS RATE SUMMER
GAS RATE WINTER                              GAS RATE ANNUAL                             MATERIAL RATE SUMMER
MATERIAL RATE WINTER                         MATERIAL RATE ANNUAL                        EMISSION RATE SO2  SUMMER
EMISSION RATE SO2  WINTER                    EMISSION RATE SO2  ANNUAL    00002.83E 00   EMISSION RATE CO   SUMMER
EMISSION RATE CO   WINTER                    EMISSION RATE CO   ANNUAL                   EMISSION RATE PART SUMMER
EMISSION RATE PART WINTER                    EMISSION RATE PART ANNUAL    00000.50E 00   EMISSION RATE  ------*
EMISSION RATE  ------*                       EMISSION RATE  ------*
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                                        SOURCE FILE LISTING                                        MARCH 13, 1970

      REGION   INSTALLATION TEST CASE          SOURCE ID  99990280              DESCRIPTIVE NAME  AREA SOURCE
 LOCATION X                 00011.60E 00    LOCATION Y                 00031.30E 00    AREA                       00707.40E 00
 LINE X                                     LINE Y                                     POLITICAL JURISDICTION     01
 OWNERSHIP - 1 CHAR.                        SOURCE TYPE - 1 CHAR.                      STACK HEIGHT LIMIT
 STACK HEIGHT                               STACK DIAMETER                             EXIT VELOCITY
 EXIT TEMPERATURE                           EXISTING CONTROL DEVICE                    EXISTING SO2 CONTROL EFF.
 EXISTING CO  CONTROL EFF.                  EXISTING PART. CONTROL EFF.                EXISTING -----* CONTR EFF.
 EXHAUST GAS VOLUME                         RATED CAPACITY                             OPERATING TIME
 SUMMER SHIFTS                              WINTER SHIFTS                              ANNUAL SHIFTS
 ORIGINAL COAL COST                         ORIGINAL OIL  COST                         ORIGINAL GAS  COST
 ORIG  COAL HEAT   CONTENT                  ORIG  OIL  HEAT   CONTENT                  ORIG  GAS  HEAT   CONTENT
 ORIG  COAL SULFUR CONTENT                  ORIG  OIL  SULFUR CONTENT                  ORIG  GAS  SULFUR CONTENT
 ELECTRICITY COST                           DEVICE FUEL COST                           LIQUID COST
 DISPOSAL FACTOR SO2                        DISPOSAL FACTOR CO                         DISPOSAL FACTOR PART.
 DISPOSAL FACTOR -----*                     MFG PROCESS UNITS - 1 CHAR                 COAL RATE SUMMER
 COAL RATE WINTER                           COAL RATE ANNUAL                           OIL RATE SUMMER
 OIL RATE WINTER                            OIL RATE ANNUAL                            GAS RATE SUMMER
 GAS RATE WINTER                            GAS RATE ANNUAL                            MATERIAL RATE SUMMER
 MATERIAL RATE WINTER                       MATERIAL RATE ANNUAL                       EMISSION RATE SO2  SUMMER
 EMISSION RATE SO2  WINTER                  EMISSION RATE SO2  ANNUAL   00000.01E 00   EMISSION RATE CO   SUMMER
 EMISSION RATE CO   WINTER                  EMISSION RATE CO   ANNUAL                  EMISSION RATE PART SUMMER
 EMISSION RATE PART WINTER                  EMISSION RATE PART ANNUAL   00000.01E 00   EMISSION RATE  ------*
 EMISSION RATE  ------*                     EMISSION RATE  ------*
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                                          SOURCE FILE LISTING                                       MARCH 13, 1970

    REGION   INSTALLATION TEST CASE           SOURCE ID  99990250              DESCRIPTIVE NAME  AREA SOURCE
 LOCATION X                    00034.80E 00   LOCATION Y                   00031.30E 00   AREA                          00707.40E 00
 LINE X                                       LINE Y                                      POLITICAL JURISDICTION      01
 OWNERSHIP - 1 CHAR.                          SOURCE TYPE - 1 CHAR.                       STACK HEIGHT LIMIT
 STACK HEIGHT                                 STACK DIAMETER                              EXIT VELOCITY
 EXIT TEMPERATURE                             EXISTING CONTROL DEVICE                     EXISTING SO2 CONTROL EFF.
 EXISTING CO  CONTROL EFF.                    EXISTING PART. CONTROL EFF.                 EXISTING -----* CONTR EFF.
 EXHAUST GAS VOLUME                           RATED CAPACITY                              OPERATING TIME
 SUMMER SHIFTS                                WINTER SHIFTS                               ANNUAL SHIFTS
 ORIGINAL COAL COST                           ORIGINAL OIL  COST                          ORIGINAL GAS  COST
 ORIG  COAL HEAT   CONTENT                    ORIG  OIL  HEAT   CONTENT                   ORIG  GAS  HEAT   CONTENT
 ORIG  COAL SULFUR CONTENT                    ORIG  OIL  SULFUR CONTENT                   ORIG  GAS  SULFUR CONTENT
 ELECTRICITY COST                             DEVICE FUEL COST                            LIQUID COST
 DISPOSAL FACTOR SO2                          DISPOSAL FACTOR CO                          DISPOSAL FACTOR PART.
 DISPOSAL FACTOR ------*                      MFG PROCESS UNITS - 1 CHAR                  COAL RATE SUMMER
 COAL RATE WINTER                             COAL RATE ANNIAL                            OIL RATE SUMMER
 OIL RATE WINTER                              OIL RATE ANNUAL                             GAS RATE SUMMER
 GAS RATE WINTER                              GAS RATE ANNUAL                             MATERIAL RATE SUMMER
 MATERIAL RATE WINTER                         MATERIAL RATE ANNUAL                        EMISSION RATE SO2  SUMMER
 EMISSION RATE SO2  WINTER                    EMISSION RATE SO2  ANNUAL    00000.77E 00   EMISSION RATE CO   SUMMER
 EMISSION RATE CO   WINTER                    EMISSION RATE CO   ANNUAL                   EMISSION RATE PART SUMMER
 EMISSION RATE PART WINTER                    EMISSION RATE PART ANNUAL    00000.16E 00   EMISSION RATE  ------*
 EMISSION RATE  ------*                       EMISSION RATE  ------*
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                                          SOURCE FILE LISTING                                              MARCH 13, 1970

   REGION   INSTALLATION TEST CASE          SOURCE ID  99990260              DESCRIPTIVE NAME  AREA SOURCE

LOCATION X                 00058.00E 00   LOCATION Y                 00031.30E 00   AREA                          00707.40E 00

LINE X                                    LINE Y                                    POLITICAL JURISDICTION      01

OWNERSHIP - 1 CHAR.                       SOURCE TYPE - 1 CHAR.                     STACK HEIGHT LIMIT

STACK HEIGHT                              STACK DIAMETER                            EXIT VELOCITY

EXIT TEMPERATURE                          EXISTING CONTROL DEVICE                   EXISTING SO2 CONTROL EFF.

EXISTING CO  CONTROL EFF.                 EXISTING PART. CONTROL EFF.               EXISTING -----* CONTR EFF.

EXHAUST GAS VOLUME                        RATED CAPACITY                            OPERATING TIME

SUMMER SHIFTS                             WINTER SHIFTS                             ANNUAL SHIFTS

ORIGINAL COAL COST                        ORIGINAL OIL  COST                        ORIGINAL GAS  COST

ORIG  COAL HEAT   CONTENT                 ORIG  OIL  HEAT   CONTENT                 ORIG  GAS  HEAT   CONTENT

ORIG  COAL SULFUR CONTENT                 ORIG  OIL  SULFUR CONTENT                 ORIG  GAS  SULFUR CONTENT

ELECTRICITY COST                          DEVICE FUEL COST                          LIQUID COST

DISPOSAL FACTOR SO2                       DISPOSAL FACTOR CO                        DISPOSAL FACTOR PART.

DISPOSAL FACTOR -----*                    MFG PROCESS UNITS - 1 CHAR                COAL RATE SUMMER

COAL RATE WINTER                          COAL RATE ANNIAL                          OIL RATE SUMMER

OIL RATE WINTER                           OIL RATE ANNUAL                           GAS RATE SUMMER

GAS RATE WINTER                           GAS RATE ANNUAL                           MATERIAL RATE SUMMER

MATERIAL RATE WINTER                      MATERIAL RATE ANNUAL                      EMISSION RATE SO2  SUMMER

EMISSION RATE SO2  WINTER                 EMISSION RATE SO2  ANNUAL   00000.63E 00  EMISSION RATE CO   SUMMER

EMISSION RATE CO   WINTER                 EMISSION RATE CO   ANNUAL                 EMISSION RATE PART SUMMER

EMISSION RATE PART WINTER                 EMISSION RATE PART ANNUAL   00000.14E 00  EMISSION RATE  ------*

EMISSION RATE  ------*                    EMISSION RATE  ------*
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                                        SOURCE FILE LISTING                                  MARCH 13, 1978

  |   REGION   INSTALLATION TEST CASE          SOURCE ID  99990270             DESCRIPTIVE NAME  AREA SOURCE      |
  LOCATION X                   00081.20E 00    LOCATION Y                 00031.30E 00    AREA                        00707.40E 00
  LINE X                                       LINE Y                                     POLITICAL JURISDICTION      02
  OWNERSHIP - 1 CHAR.                          SOURCE TYPE - 1 CHAR.                      STACK HEIGHT LIMIT
  STACK HEIGHT                                 STACK DIAMETER                             EXIT VELOCITY
  EXIT TEMPERATURE                             EXISTING CONTROL DEVICE                    EXISTING SO2 CONTROL EFF.
  EXISTING CO  CONTROL EFF.                    EXISTING PART. CONTROL EFF.                EXISTING -----* CONTR EFF.
  EXHAUST GAS VOLUME                           RATED CAPACITY                             OPERATING TIME
  SUMMER SHIFTS                                WINTER SHIFTS                              ANNUAL SHIFTS
  ORIGINAL COAL COST                           ORIGINAL OIL  COST                         ORIGINAL GAS  COST
  ORIG  COAL HEAT   CONTENT                    ORIG  OIL  HEAT   CONTENT                  ORIG  GAS  HEAT   CONTENT
  ORIG  COAL SULFUR CONTENT                    ORIG  OIL  SULFUR CONTENT                  ORIG  GAS  SULFUR CONTENT
  ELECTRICITY COST                             DEVICE FUEL COST                           LIQUID COST
  DISPOSAL FACTOR SO2                          DISPOSAL FACTOR CO                         DISPOSAL FACTOR PART.
  DISPOSAL FACTOR -----*                       MFG PROCESS UNITS - 1 CHAR                 COAL RATE SUMMER
  COAL RATE WINTER                             COAL RATE ANNUAL                           OIL RATE SUMMER
  OIL RATE WINTER                              OIL RATE ANNUAL                            GAS RATE SUMMER
  GAS RATE WINTER                              GAS RATE ANNUAL                            MATERIAL RATE SUMMER
  MATERIAL RATE WINTER                         MATERIAL RATE ANNUAL                       EMISSION RATE SO2  SUMMER
  EMISSION RATE SO2  WINTER                    EMISSION RATE SO2  ANNUAL   00000.54E 00   EMISSION RATE CO   SUMMER
  EMISSION RATE CO   WINTER                    EMISSION RATE CO   ANNUAL                  EMISSION RATE PART SUMMER
  EMISSION RATE PART WINTER                    EMISSION RATE PART ANNUAL   00000.09E 00   EMISSION RATE  ------*
  EMISSION RATE  ------*                       EMISSION RATE  ------*
```

```
                                        SOURCE FILE LISTING                                      MARCH 13, 1970

  REGION   INSTALLATION TEST CASE        SOURCE ID  99990280           DESCRIPTIVE NAME  AREA SOURCE

LOCATION X                  00104.40E 00  LOCATION Y                 00031.30E 00   AREA                      00707.40E 00
LINE X                                    LINE Y                                    POLITICAL JURISDICTION     02
OWNERSHIP - 1 CHAR.                       SOURCE TYPE - 1 CHAR.                     STACK HEIGHT LIMIT
STACK HEIGHT                              STACK DIAMETER                            EXIT VELOCITY
EXIT TEMPERATURE                          EXISTING CONTROL DEVICE                   EXISTING SO2 CONTROL EFF.
EXISTING CO  CONTROL EFF.                 EXISTING PART. CONTROL EFF.               EXISTING -----* CONTR EFF.
EXHAUST GAS VOLUME                        RATED CAPACITY                            OPERATING TIME
SUMMER SHIFTS                             WINTER SHIFTS                             ANNUAL SHIFTS
ORIGINAL COAL COST                        ORIGINAL OIL  COST                        ORIGINAL GAS  COST
ORIG  COAL HEAT   CONTENT                 ORIG  OIL  HEAT   CONTENT                 ORIG  GAS  HEAT   CONTENT
ORIG  COAL SULFUR CONTENT                 ORIG  OIL  SULFUR CONTENT                 ORIG  GAS  SULFUR CONTENT
ELECTRICITY COST                          DEVICE FUEL COST                          LIQUID COST
DISPOSAL FACTOR SO2                       DISPOSAL FACTOR CO                        DISPOSAL FACTOR PART.
DISPOSAL FACTOR -----*                    MFG PROCESS UNITS - 1 CHAR                COAL RATE SUMMER
COAL RATE WINTER                          COAL RATE ANNIAL                          OIL RATE SUMMER
OIL RATE WINTER                           OIL RATE ANNUAL                           GAS RATE SUMMER
GAS RATE WINTER                           GAS RATE ANNUAL                           MATERIAL RATE SUMMER
MATERIAL RATE WINTER                      MATERIAL RATE ANNUAL                      EMISSION RATE SO2  SUMMER
EMISSION RATE SO2  WINTER                 EMISSION RATE SO2  ANNUAL   00000.23E 00  EMISSION RATE CO   SUMMER
EMISSION RATE CO   WINTER                 EMISSION RATE CO   ANNUAL                 EMISSION RATE PART SUMMER
EMISSION RATE PART WINTER                 EMISSION RATE PART ANNUAL   00000.06E 00  EMISSION RATE  ------*
EMISSION RATE  ------*                    EMISSION RATE  ------*
```

```
                                   SOURCE FILE LISTING                                       MARCH 13, 1970

      REGION   INSTALLATION TEST CASE          SOURCE ID  99990290            DESCRIPTIVE NAME  AREA SOURCE
  LOCATION X                 00127.60E 00   LOCATION Y                  00031.30E 00    AREA                            00707.40E 00
  LINE X                                    LINE Y                                      POLITICAL JURISDICTION      02
  OWNERSHIP - 1 CHAR.                       SOURCE TYPE - 1 CHAR.                       STACK HEIGHT LIMIT
  STACK HEIGHT                              STACK DIAMETER                              EXIT VELOCITY
  EXIT TEMPERATURE                          EXISTING CONTROL DEVICE                     EXISTING SO2 CONTROL EFF.
  EXISTING CO  CONTROL EFF.                 EXISTING PART. CONTROL EFF.                 EXISTING -----* CONTR EFF.
  EXHAUST GAS VOLUME                        RATED CAPACITY                              OPERATING TIME
  SUMMER SHIFTS                             WINTER SHIFTS                               ANNUAL SHIFTS
  ORIGINAL COAL COST                        ORIGINAL OIL  COST                          ORIGINAL GAS  COST
  ORIG  COAL HEAT   CONTENT                 ORIG  OIL  HEAT   CONTENT                   ORIG  GAS  HEAT   CONTENT
  ORIG  COAL SULFUR CONTENT                 ORIG  OIL  SULFUR CONTENT                   ORIG  GAS  SULFUR CONTENT
  ELECTRICITY COST                          DEVICE FUEL COST                            LIQUID COST
  DISPOSAL FACTOR SO2                       DISPOSAL FACTOR CO                          DISPOSAL FACTOR PART.
  DISPOSAL FACTOR -----*                    EPG PROCESS UNITS - 1 CHAR                  COAL RATE SUMMER
  COAL RATE WINTER                          COAL RATE ANNUAL                            OIL RATE SUMMER
  OIL RATE WINTER                           OIL RATE ANNUAL                             GAS RATE SUMMER
  GAS RATE WINTER                           GAS RATE ANNUAL                             MATERIAL RATE SUMMER
  MATERIAL RATE WINTER                      MATERIAL RATE ANNUAL                        EMISSION RATE SO2  SUMMER
  EMISSION RATE SO2  WINTER                 EMISSION RATE SO2  ANNUAL   00000.38E 00    EMISSION RATE CO   SUMMER
  EMISSION RATE CO   WINTER                 EMISSION RATE CO   ANNUAL                   EMISSION RATE PART SUMMER
  EMISSION RATE PART WINTER                 EMISSION RATE PART ANNUAL   00000.06E 00    EMISSION RATE  ------*
  EMISSION RATE  ------*                    EMISSION RATE  ------*
```

Figure 9-6.

```
                    DEVICE    FILE
                         INPUT

   9C7000    001DATE
   907C01    014   100.  E   015    15.  E   016    20.0 E
   9C7C01    001WET SCRUBBER 002HI EFFIC     003    28.86E-01004     2.28E-01
   9C7001    028    98.0 E
   9C7001    024     1.0 E
   907001    017     0.5 E   018     1.0 E   019     2.0 E   020     4.0 E
   907002    001WET SCRUBBER 002MED EFFIC    003    28.86E-01004     2.28E-01
   9C7002    028    90.0 E
   907002    024     1.0 E
   9C7C02    017     3.75E-01018     0.75E   019     1.5 E   020     3.0 E
   907002    014   200.  E   015    15.  E   016     4.0 E
   907C03    028    80.0 E
```

Figure 9-7.

```
                          DEVICE    FILE
                        DICTIONARY  LISTING

 001  DESCRIPTION FIELD (1 OF 2)                        A   13 CHARACTERS
 002  DESCRIPTION FIELD (2 OF 2)                        A   13 CHARACTERS
 003  MFG'S PRICE COEFF.  #1                            N  -1.20E 03 1.00E 02
 004  MFG'S PRICE COEFF.  #2                            N  -1.00E 01 1.50E 02
 005  MFG'S PRICE COEFF.  #3                            N  -1.00E 01 1.00E 02
 006  TRANSPORTATION COST FACTOR PERCENTAGE             N   0.00E 00 2.00E 02
 007  ERECTION COST FACTOR       PERCENTAGE             N   0.00E 00 2.00E 02
 008  A & E COST FACTOR          PERCENTAGE             N   0.00E 00 2.00E 02
 009  AUX EQUIP COST FACTOR      PERCENTAGE             N   0.00E 00 2.00E 02
 010  UTIL CONN. COST FACTOR     PERCENTAGE             N   0.00E 00 2.00E 02
 011  START-UP COST FACTOR       PERCENTAGE             N   0.00E 00 2.00E 02
 012  SPARE PARTS COST FACTOR    PERCENTAGE             N   0.00E 00 2.00E 02
 013  LAND & BLDGS COST FACTOR   PERCENTAGE             N   0.00E 00 2.00E 02
 014  TOTAL INST COST FACTOR     PERCENTAGE             N   0.00E 00 5.00E 02
 015  LIFE                       YEARS                  N   0.00E 00 3.00E 01
 016  PRESS. DROP                IN. H20                N   0.00E 00 8.00E 01
 017  LABOR QTY  SM PLANT        HRS LBR/HR OF OPER     N   0.00E 00 1.00E 00
 018  LABOR QTY MED PLANT        HRS LBR/HR OF OPER     N   0.00E 00 3.00E 00
 019  LABOR QTY  LARGE PLANT     HRS LBR/HR OF OPER     N   5.00E-01 5.00E 00
 020  LABOR QTY  X-LARGE PLANT   HRS LBR/HR OF OPER     N   1.00E 00 1.00E 01
 021  CHEM COST                  $/TON                  N   0.00E 00 1.00E 07
 022  DISPOSAL COST/CREDIT SO2   $/TON                  N  -3.00E 01 5.00E 00
 023  DISPOSAL COST/CREDIT CO    $/TON                  N  -5.00E 00 5.00E 00
 024  DISPOSAL COST/CREDIT PART  $/TON                  N  -5.00E-01 5.00E 00
 025  DISPOSAL COST/CREDIT OTHER $/TON                  N  -1.00E 07 1.00E 07
 026  DEVICE FUEL FACTOR                                N   0.00E 00 1.20E 00
 027  RATED EFF  SO2             PERCENTAGE             N   0.00E 00 1.00E 02
 028  RATED EFF  CO              PERCENTAGE             N   0.00E 00 1.00E 02
 029  RATED EFF  PART.           PERCENTAGE             N   0.00E 00 1.00E 02
 030  RATED EFF  OTHER           PERCENTAGE             N   0.00E 00 1.00E 02
```

Figure 9-8.

```
  DEVICE    FILE
EDIT ERROR LISTING

  END ERROR LIST

  EDIT  SUMMARY

CARDS IN           7
CARDS REJECTED     0
CARD RECORDS OUT   7
```

Figure 9-9.

```
                      DEVICE FILE

             UPDATE AND MAINTENANCE SUMMARY


MASTER FILE RECORDS READ IN                  37

TRANSACTION FILE RECORDS READ IN              7

MASTER FILE RECORDS OVERLAYED                 7

MASTER FILE RECORDS INSERTED                  0

MASTER FILE RECORDS DELETED                   0

RECORDS ON NEW MASTER FILE                   37
```

Figure 9-10.

```
                                   DEVICE FILE LISTING                                     MARCH 13, 1970

   REGION   INSTALLATION TEST CASE        DEVICE ID  001                 DESCRIPTIVE NAME  WET SCRUBBER HI EFFIC
 MFG'S PRICE COEFF.  #1      00028.86E-01   MFG'S PRICE COEFF.  #2      00002.28E-01   MFG'S PRICE COEFF.  #3
 TRANSPORTATION COST FACTOR                 ERECTION COST FACTOR                       A & E COST FACTOR
 AUX EQUIP COST FACTOR                      UTIL CONN. COST FACTOR                     START-UP COST FACTOR
 SPARE PARTS COST FACTOR                    LAND & BLDGS COST FACTOR                   TOTAL INST COST FACTOR      00200.00E 00
 LIFE                        00015.00E 00   PRESS. DROP                 00020.00E 00   LABOR QTY  SM PLANT         00000.50E 00
 LABOR QTY MED PLANT         00001.00E 00   LABOR QTY  LARGE PLANT      00002.00E 00   LABOR QTY  X-LARGE PLANT    00004.00E 00
 CHEM COST                                  DISPOSAL COST/CREDIT SO2                   DISPOSAL COST/CREDIT CO
 DISPOSAL COST/CREDIT PART   00001.00E 00   DISPOSAL COST/CREDIT OTHER                 DEVICE FUEL FACTOR          00000.00E 00
 RATED EFF  SO2              00000.00E 00   RATED EFF  CO               00000.00E 00   RATED EFF  PART.            00098.00E 00
 RATED EFF  OTHER

   REGION   INSTALLATION TEST CASE        DEVICE ID  002                 DESCRIPTIVE NAME  WET SCRUBBER MED EFFIC
 MFG'S PRICE COEFF.  #1      00028.86E-01   MFG'S PRICE COEFF.  #2      00002.28E-01   MFG'S PRICE COEFF.  #3
 TRANSPORTATION COST FACTOR                 ERECTION COST FACTOR                       A & E COST FACTOR
 AUX EQUIP COST FACTOR                      UTIL CONN. COST FACTOR                     START-UP COST FACTOR
 SPARE PARTS COST FACTOR                    LAND & BLDGS COST FACTOR                   TOTAL INST COST FACTOR      00200.00E 00
 LIFE                        00015.00E 00   PRESS. DROP                 00004.00E 00   LABOR QTY  SM PLANT         00003.75E-01
 LABOR QTY MED PLANT         00000.75E 00   LABOR QTY  LARGE PLANT      00001.50E 00   LABOR QTY  X-LARGE PLANT    00003.00E 00
 CHEM COST                                  DISPOSAL COST/CREDIT SO2                   DISPOSAL COST/CREDIT CO
 DISPOSAL COST/CREDIT PART   00001.00E 00   DISPOSAL COST/CREDIT OTHER                 DEVICE FUEL FACTOR          00000.00E 00
 RATED EFF  SO2              00000.00E 00   RATED EFF  CO               00000.00E 00   RATED EFF  PART.            00090.00E 00
 RATED EFF  OTHER
```

```
                                        DEVICE FILE LISTING                                          MARCH 13, 1970

      REGION   INSTALLATION TEST CASE           DEVICE ID  003                  DESCRIPTIVE NAME  WET SCRUBBER LO EFFIC
  MFG'S PRICE COEFF.  #1        00012.57E-01   MFG'S PRICE COEFF.  #2        00001.45E-01   MFG'S PRICE COEFF.  #3
  TRANSPORTATION COST FACTOR                   ERECTION COST FACTOR                         A & E COST FACTOR
  AUX EQUIP COST FACTOR                        UTIL CONN. COST FACTOR                       START-UP COST FACTOR
  SPARE PARTS COST FACTOR                      LAND & BLDGS COST FACTOR                     TOTAL INST COST FACTOR        00200.00E 00
  LIFE                          00015.00E 00   PRESS. DROP                   00003.00E 00   LABOR QTY  SM PLANT           00003.75E-01
  LABOR QTY MED PLANT           00000.75E 00   LABOR QTY  LARGE PLANT        00001.50E 00   LABOR QTY  X-LARGE PLANT      00003.00E 00
  CHEM COST                                    DISPOSAL COST/CREDIT SO2                     DISPOSAL COST/CREDIT CO
  DISPOSAL COST/CREDIT PART     00001.00E 00   DISPOSAL COST/CREDIT OTHER                   DEVICE FUEL FACTOR            00000.00E 00
  RATED EFF  SO2                00000.00E 00   RATED EFF  CO                 00000.00E 00   RATED EFF  PART.              00080.00E 00
  RATED EFF  OTHER

      REGION   INSTALLATION TEST CASE           DEVICE ID  004                  DESCRIPTIVE NAME  GRAV COLLECTOR HI EFFIC
  MFG'S PRICE COEFF.  #1       -00004.45E-01   MFG'S PRICE COEFF.  #2        00003.26E-01   MFG'S PRICE COEFF.  #3
  TRANSPORTATION COST FACTOR                   ERECTION COST FACTOR                         A & E COST FACTOR
  AUX EQUIP COST FACTOR                        UTIL CONN. COST FACTOR                       START-UP COST FACTOR
  SPARE PARTS COST FACTOR                      LAND & BLDGS COST FACTOR                     TOTAL INST COST FACTOR        00100.00E 00
  LIFE                          00015.00E 00   PRESS. DROP                   00000.50E 00   LABOR QTY  SM PLANT           00000.25E 00
  LABOR QTY MED PLANT           00000.50E 00   LABOR QTY  LARGE PLANT        00001.00E 00   LABOR QTY  X-LARGE PLANT      00002.00E 00
  CHEM COST                                    DISPOSAL COST/CREDIT SO2                     DISPOSAL COST/CREDIT CO
  DISPOSAL COST/CREDIT PART     00001.00E 00   DISPOSAL COST/CREDIT OTHER                   DEVICE FUEL FACTOR            00000.00E 00
  RATED EFF  SO2                00000.00E 00   RATED EFF  CO                 00000.00E 00   RATED EFF  PART.              00006.00E+01
  RATED EFF  OTHER
```

```
                                   DEVICE FILE LISTING                                          MARCH 13, 1970

   REGION   INSTALLATION TEST CASE          DEVICE ID  005                   DESCRIPTIVE NAME  GRAV COLLECTOR MED EFFIC
MFG'S PRICE COEFF.  #1       -00004.20E-02  MFG'S PRICE COEFF.  #2       00001.55E-01  MFG'S PRICE COEFF.  #3
TRANSPORTATION COST FACTOR                  ERECTION COST FACTOR                       A & E COST FACTOR
AUX EQUIP COST FACTOR                       UTIL CONN. COST FACTOR                     START-UP COST FACTOR
SPARE PARTS COST FACTOR                     LAND & BLDGS COST FACTOR                   TOTAL INST COST FACTOR       00100.00E 00
LIFE                          00015.00E 00  PRESS. DROP                  00000.50E 00  LABOR QTY  SM PLANT          00000.25E 00
LABOR QTY MED PLANT           00000.50E 00  LABOR QTY  LARGE PLANT       00001.00E 00  LABOR QTY  X-LARGE PLANT     00002.00E 00
CHEM COST                                   DISPOSAL COST/CREDIT SO2                   DISPOSAL COST/CREDIT CO
DISPOSAL COST/CREDIT PART     00001.00E 00  DISPOSAL COST/CREDIT OTHER                 DEVICE FUEL FACTOR           00000.00E 00
RATED EFF  SO2                00000.00E 00  RATED EFF  CO                00000.00E 00  RATED EFF  PART.             00040.00E 00
RATED EFF  OTHER

   REGION   INSTALLATION TEST CASE          DEVICE ID  006                   DESCRIPTIVE NAME  GRAV COLLECTOR LO EFFIC
MFG'S PRICE COEFF.  #1        00003.00E-03  MFG'S PRICE COEFF.  #2       00005.60E-02  MFG'S PRICE COEFF.  #3
TRANSPORTATION COST FACTOR                  ERECTION COST FACTOR                       A & E COST FACTOR
AUX EQUIP COST FACTOR                       UTIL CONN. COST FACTOR                     START-UP COST FACTOR
SPARE PARTS COST FACTOR                     LAND & BLDGS COST FACTOR                   TOTAL INST COST FACTOR       00100.00E 00
LIFE                          00015.00E 00  PRESS. DROP                  00000.50E 00  LABOR QTY  SM PLANT          00000.25E 00
LABOR QTY MED PLANT           00000.50E 00  LABOR QTY  LARGE PLANT       00001.00E 00  LABOR QTY  X-LARGE PLANT     00002.00E 00
CHEM COST                                   DISPOSAL COST/CREDIT SO2                   DISPOSAL COST/CREDIT CO
DISPOSAL COST/CREDIT PART     00001.00E 00  DISPOSAL COST/CREDIT OTHER                 DEVICE FUEL FACTOR           00000.00E 00
RATED EFF  SO2                00000.00E 00  RATED EFF  CO                00000.00E 00  RATED EFF  PART.             00030.00E 00
RATED EFF  OTHER
```

```
                                          DEVICE FILE LISTING                                    MARCH 13, 1970

     REGION   INSTALLATION TEST CASE            DEVICE ID  007                    DESCRIPTIVE NAME  CYCLONE HI EFFIC

  MFG'S PRICE COEFF.  #1        00024.13E-01    MFG'S PRICE COEFF.  #2        00001.97E-01    MFG'S PRICE COEFF.  #3
  TRANSPORTATION COST FACTOR                    ERECTION COST FACTOR                          A & E COST FACTOR
  AUX EQUIP COST FACTOR                         UTIL CONN. COST FACTOR                        START-UP COST FACTOR
  SPARE PARTS COST FACTOR                       LAND & BLDGS COST FACTOR                      TOTAL INST COST FACTOR        00100.00E 00
  LIFE                          00015.00E 00    PRESS. DROP                   00004.00E 00    LABOR QTY  SM PLANT           00000.25E 00
  LABOR QTY MED PLANT           00000.50E 00    LABOR QTY  LARGE PLANT        00001.00E 00    LABOR QTY  X-LARGE PLANT      00002.00E 00
  CHEM COST                                     DISPOSAL COST/CREDIT SO2                      DISPOSAL COST/CREDIT CO
  DISPOSAL COST/CREDIT PART     00001.00E 00    DISPOSAL COST/CREDIT OTHER                    DEVICE FUEL FACTOR            00000.00E 00
  RATED EFF  SO2                00000.00E 00    RATED EFF  CO                 00000.00E 00    RATED EFF  PART.              00085.00E 00
  RATED EFF  OTHER

     REGION   INSTALLATION TEST CASE            DEVICE ID  008                    DESCRIPTIVE NAME  CYCLONE MED EFFIC

  MFG'S PRICE COEFF.  #1        00015.07E-01    MFG'S PRICE COEFF.  #2        00001.57E-01    MFG'S PRICE COEFF.  #3
  TRANSPORTATION COST FACTOR                    ERECTION COST FACTOR                          A & E COST FACTOR
  AUX EQUIP COST FACTOR                         UTIL CONN. COST FACTOR                        START-UP COST FACTOR
  SPARE PARTS COST FACTOR                       LAND & BLDGS COST FACTOR                      TOTAL INST COST FACTOR        00100.00E 00
  LIFE                          00015.00E 00    PRESS. DROP                   00003.00E 00    LABOR QTY  SM PLANT           00000.25E 00
  LABOR QTY MED PLANT           00000.50E 00    LABOR QTY  LARGE PLANT        00001.00E 00    LABOR QTY  X-LARGE PLANT      00002.00E 00
  CHEM COST                                     DISPOSAL COST/CREDIT SO2                      DISPOSAL COST/CREDIT CO
  DISPOSAL COST/CREDIT PART     00001.00E 00    DISPOSAL COST/CREDIT OTHER                    DEVICE FUEL FACTOR            00000.00E 00
  RATED EFF  SO2                00000.00E 00    RATED EFF  CO                 00000.00E 00    RATED EFF  PART.              00075.00E 00
  RATED EFF  OTHER
```

```
                                        DEVICE FILE LISTING                                       MARCH 13, 1970

  REGION   INSTALLATION TEST CASE          DEVICE ID  009                   DESCRIPTIVE NAME  CYCLONE LO EFFIC
MFG'S PRICE COEFF.  #1       00002.44E-01   MFG'S PRICE COEFF.  #2        00009.90E-02   MFG'S PRICE COEFF.  #3
TRANSPORTATION COST FACTOR                   ERECTION COST FACTOR                         A & E COST FACTOR
AUX EQUIP COST FACTOR                        UTIL CONN. COST FACTOR                       START-UP COST FACTOR
SPARE PARTS COST FACTOR                      LAND & BLDGS COST FACTOR                     TOTAL INST COST FACTOR       00100.00E 00
LIFE                         00015.00E 00   PRESS. DROP                   00002.00E 00   LABOR QTY  SM PLANT          00000.25E 00
LABOR QTY MED PLANT          00000.50E 00   LABOR QTY  LARGE PLANT        00001.00E 00   LABOR QTY  X-LARGE PLANT     00002.00E 00
CHEM COST                                    DISPOSAL COST/CREDIT SO2                     DISPOSAL COST/CREDIT CO
DISPOSAL COST/CREDIT PART    00001.00E 00   DISPOSAL COST/CREDIT OTHER                   DEVICE FUEL FACTOR           00000.00E 00
RATED EFF  SO2               00000.00E 00   RATED EFF  CO                 00000.00E 00   RATED EFF  PART.             00060.00E 00
RATED EFF  OTHER

  REGION   INSTALLATION TEST CASE          DEVICE ID  010                   DESCRIPTIVE NAME  ELECT PRECIP HI EFFIC
MFG'S PRICE COEFF.  #1       00042.41E 00   MFG'S PRICE COEFF.  #2        00006.23E-01   MFG'S PRICE COEFF.  #3
TRANSPORTATION COST FACTOR                   ERECTION COST FACTOR                         A & E COST FACTOR
AUX EQUIP COST FACTOR                        UTIL CONN. COST FACTOR                       START-UP COST FACTOR
SPARE PARTS COST FACTOR                      LAND & BLDGS COST FACTOR                     TOTAL INST COST FACTOR       00100.00E 00
LIFE                         00015.00E 00   PRESS. DROP                   00000.50E 00   LABOR QTY  SM PLANT          00000.50E 00
LABOR QTY MED PLANT          00001.50E 00   LABOR QTY  LARGE PLANT        00003.00E 00   LABOR QTY  X-LARGE PLANT     00006.00E 00
CHEM COST                                    DISPOSAL COST/CREDIT SO2                     DISPOSAL COST/CREDIT CO
DISPOSAL COST/CREDIT PART    00001.00E 00   DISPOSAL COST/CREDIT OTHER                   DEVICE FUEL FACTOR           00000.00E 00
RATED EFF  SO2               00000.00E 00   RATED EFF  CO                 00000.00E 00   RATED EFF  PART.             00099.00E 00
RATED EFF  OTHER
```

```
                                          DEVICE FILE LISTING                                       MARCH 13, 1970

    |   REGION   INSTALLATION TEST CASE          DEVICE ID  011                 DESCRIPTIVE NAME  ELECT PRECIP MED EFFIC |
  MFG'S PRICE COEFF.  #1        00031.24E 00   MFG'S PRICE COEFF.  #2        00004.41E-01   MFG'S PRICE COEFF.  #3
  TRANSPORTATION COST FACTOR                   ERECTION COST FACTOR                         A & E COST FACTOR
  AUX EQUIP COST FACTOR                        UTIL CONN. COST FACTOR                       START-UP COST FACTOR
  SPARE PARTS COST FACTOR                      LAND & BLDGS COST FACTOR                     TOTAL INST COST FACTOR        00100.00E 00
  LIFE                          00015.00E 00   PRESS. DROP                   00000.50E 00   LABOR QTY  SM PLANT           00000.50E 00
  LABOR QTY MED PLANT           00001.50E 00   LABOR QTY  LARGE PLANT        00003.00E 00   LABOR QTY  X-LARGE PLANT      00006.00E 00
  CHEM COST                                    DISPOSAL COST/CREDIT SO2                     DISPOSAL COST/CREDIT CO
  DISPOSAL COST/CREDIT PART     00001.00E 00   DISPOSAL COST/CREDIT OTHER                   DEVICE FUEL FACTOR            00000.00E 00
  RATED EFF  SO2                00000.00E 00   RATED EFF  CO                 00000.00E 00   RATED EFF  PART.              00095.00E 00
  RATED EFF  OTHER

    |   REGION   INSTALLATION TEST CASE          DEVICE ID  012                 DESCRIPTIVE NAME  ELECT PRECIP LO EFFIC  |
  MFG'S PRICE COEFF.  #1        00019.69E 00   MFG'S PRICE COEFF.  #2        00003.18E-01   MFG'S PRICE COEFF.  #3
  TRANSPORTATION COST FACTOR                   ERECTION COST FACTOR                         A & E COST FACTOR
  AUX EQUIP COST FACTOR                        UTIL CONN. COST FACTOR                       START-UP COST FACTOR
  SPARE PARTS COST FACTOR                      LAND & BLDGS COST FACTOR                     TOTAL INST COST FACTOR        00100.00E 00
  LIFE                          00015.00E 00   PRESS. DROP                   00000.50E 00   LABOR QTY  SM PLANT           00000.50E 00
  LABOR QTY MED PLANT           00001.50E 00   LABOR QTY  LARGE PLANT        00003.00E 00   LABOR QTY  X-LARGE PLANT      00006.00E 00
  CHEM COST                                    DISPOSAL COST/CREDIT SO2                     DISPOSAL COST/CREDIT CO
  DISPOSAL COST/CREDIT PART     00001.00E 00   DISPOSAL COST/CREDIT OTHER                   DEVICE FUEL FACTOR            00000.00E 00
  RATED EFF  SO2                00000.00E 00   RATED EFF  CO                 00000.00E 00   RATED EFF  PART.              00090.00E 00
  RATED EFF  OTHER
```

```
                                             DEVICE FILE LISTING                                       MARCH 13, 1970

    REGION   INSTALLATION TEST CASE          DEVICE ID  013                       DESCRIPTIVE NAME  GAS SCRUBBER
  MFG'S PRICE COEFF.  #1       00031.75E-01    MFG'S PRICE COEFF.  #2      00002.51E-01    MFG'S PRICE COEFF.  #3
  TRANSPORTATION COST FACTOR                    ERECTION COST FACTOR                         A & E COST FACTOR
  AUX EQUIP COST FACTOR                         UTIL CONN. COST FACTOR                       START-UP COST FACTOR
  SPARE PARTS COST FACTOR                       LAND & BLDGS COST FACTOR                     TOTAL INST COST FACTOR       00200.00E 00
  LIFE                         00015.00E 00    PRESS. DROP                 00005.00E 00    LABOR QTY  SM PLANT          00003.75E-01
  LABOR QTY MED PLANT          00000.75E 00    LABOR QTY  LARGE PLANT      00001.50E 00    LABOR QTY  X-LARGE PLANT     00003.00E 00
  CHEM COST                    00010.00E 00    DISPOSAL COST/CREDIT SO2                      DISPOSAL COST/CREDIT CO
  DISPOSAL COST/CREDIT PART    00001.00E 00    DISPOSAL COST/CREDIT OTHER                    DEVICE FUEL FACTOR           00000.00E 00
  RATED EFF  SO2               00080.00E 00    RATED EFF  CO               00000.00E 00    RATED EFF  PART.             00090.00E 00
  RATED EFF  OTHER

    REGION   INSTALLATION TEST CASE          DEVICE ID  014                       DESCRIPTIVE NAME  MIST ELIMINATOR HI VEL
  MFG'S PRICE COEFF.  #1       00026.58E-01    MFG'S PRICE COEFF.  #2      00003.25E-01    MFG'S PRICE COEFF.  #3
  TRANSPORTATION COST FACTOR                    ERECTION COST FACTOR                         A & E COST FACTOR
  AUX EQUIP COST FACTOR                         UTIL CONN. COST FACTOR                       START-UP COST FACTOR
  SPARE PARTS COST FACTOR                       LAND & BLDGS COST FACTOR                     TOTAL INST COST FACTOR       00100.00E 00
  LIFE                         00015.00E 00    PRESS. DROP                 00010.00E 00    LABOR QTY  SM PLANT          00000.25E 00
  LABOR QTY MED PLANT          00000.50E 00    LABOR QTY  LARGE PLANT      00001.00E 00    LABOR QTY  X-LARGE PLANT     00002.00E 00
  CHEM COST                                     DISPOSAL COST/CREDIT SO2                      DISPOSAL COST/CREDIT CO
  DISPOSAL COST/CREDIT PART                     DISPOSAL COST/CREDIT OTHER                    DEVICE FUEL FACTOR           00000.00E 00
  RATED EFF  SO2               00000.00E 00    RATED EFF  CO               00000.00E 00    RATED EFF  PART.             00099.00E 00
  RATED EFF  OTHER
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                                    DEVICE FILE LISTING                                         MARCH 13, 1970

    REGION   INSTALLATION TEST CASE            DEVICE ID  015                    DESCRIPTIVE NAME  MIST ELIMINATOR LO VEL
 MFG'S PRICE COEFF.  #1       00017.72E-01   MFG'S PRICE COEFF.  #2       00002.17E-01   MFG'S PRICE COEFF.  #3
 TRANSPORTATION COST FACTOR                  ERECTION COST FACTOR                        A & E COST FACTOR
 AUX EQUIP COST FACTOR                       UTIL CONN. COST FACTOR                      START-UP COST FACTOR
 SPARE PARTS COST FACTOR                     LAND & BLDGS COST FACTOR                    TOTAL INST COST FACTOR       00100.00E 00
 LIFE                         00015.00E 00   PRESS. DROP                  00005.00E 00   LABOR QTY  SM PLANT          00000.25E 00
 LABOR QTY MED PLANT          00000.50E 00   LABOR QTY  LARGE PLANT       00001.00E 00   LABOR QTY  X-LARGE PLANT     00002.00E 00
 CHEM COST                                   DISPOSAL COST/CREDIT SO2                    DISPOSAL COST/CREDIT CO
 DISPOSAL COST/CREDIT PART                   DISPOSAL COST/CREDIT OTHER                  DEVICE FUEL FACTOR           00000.00E 00
 RATED EFF  SO2               00000.00E 00   RATED EFF  CO                00000.00E 00   RATED EFF  PART.             00085.00E 00
 RATED EFF  OTHER

    REGION   INSTALLATION TEST CASE            DEVICE ID  016                    DESCRIPTIVE NAME  FABRIC FILTER HI TEMP
 MFG'S PRICE COEFF.  #1       00014.49E-01   MFG'S PRICE COEFF.  #2       00008.38E-01   MFG'S PRICE COEFF.  #3
 TRANSPORTATION COST FACTOR                  ERECTION COST FACTOR                        A & E COST FACTOR
 AUX EQUIP COST FACTOR                       UTIL CONN. COST FACTOR                      START-UP COST FACTOR
 SPARE PARTS COST FACTOR                     LAND & BLDGS COST FACTOR                    TOTAL INST COST FACTOR       00100.00E 00
 LIFE                         00015.00E 00   PRESS. DROP                  00005.00E 00   LABOR QTY  SM PLANT          00000.50E 00
 LABOR QTY MED PLANT          00001.25E 00   LABOR QTY  LARGE PLANT       00002.50E 00   LABOR QTY  X-LARGE PLANT     00005.00E 00
 CHEM COST                                   DISPOSAL COST/CREDIT SO2                    DISPOSAL COST/CREDIT CO
 DISPOSAL COST/CREDIT PART    00001.00E 00   DISPOSAL COST/CREDIT OTHER                  DEVICE FUEL FACTOR           00000.00E 00
 RATED EFF  SO2               00000.00E 00   RATED EFF  CO                00000.00E 00   RATED EFF  PART.             00099.00E 00
 RATED EFF  OTHER
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                                   DEVICE FILE LISTING                                   MARCH 13, 1970

  REGION  INSTALLATION TEST CASE        DEVICE ID  017                 DESCRIPTIVE NAME  FABRIC FILTER MED TEMP
MFG'S PRICE COEFF.  #1      00034.78E-01  MFG'S PRICE COEFF.  #2       00004.48E-01  MFG'S PRICE COEFF.  #3
TRANSPORTATION COST FACTOR                ERECTION COST FACTOR                       A & E COST FACTOR
AUX EQUIP COST FACTOR                     UTIL CONS. COST FACTOR                     START-UP COST FACTOR
SPARE PARTS COST FACTOR                   LAND & BLDGS COST FACTOR                   TOTAL INST COST FACTOR   00100.00E 00
LIFE                        00015.00E 00  PRESS. DROP                  00005.00E 00  LABOR QTY  SM PLANT      00000.50E 00
LABOR QTY MED PLANT         00001.25E 00  LABOR QTY  LARGE PLANT       00002.50E 00  LABOR QTY  X-LARGE PLANT 00005.00E 00
CHEM COST                                 DISPOSAL COST/CREDIT SO2                   DISPOSAL COST/CREDIT CO
DISPOSAL COST/CREDIT PART   00001.00E 00  DISPOSAL COST/CREDIT OTHER                 DEVICE FUEL FACTOR       00000.00E 00
RATED EFF  SO2              00000.00E 00  RATED EFF  CO                00000.00E 00  RATED EFF  PART.         00099.00E 00
RATED EFF  OTHER

  REGION  INSTALLATION TEST CASE        DEVICE ID  018                 DESCRIPTIVE NAME  FABRIC FILTER LO TEMP
MFG'S PRICE COEFF.  #1      00026.58E-01  MFG'S PRICE COEFF.  #2       00003.25E-01  MFG'S PRICE COEFF.  #3
TRANSPORTATION COST FACTOR                ERECTION COST FACTOR                       A & E COST FACTOR
AUX EQUIP COST FACTOR                     UTIL CONS. COST FACTOR                     START-UP COST FACTOR
SPARE PARTS COST FACTOR                   LAND & BLDGS COST FACTOR                   TOTAL INST COST FACTOR   00100.00E 00
LIFE                        00015.00E 00  PRESS. DROP                  00005.00E 00  LABOR QTY  SM PLANT      00000.50E 00
LABOR QTY MED PLANT         00001.25E 00  LABOR QTY  LARGE PLANT       00002.50E 00  LABOR QTY  X-LARGE PLANT 00005.00E 00
CHEM COST                                 DISPOSAL COST/CREDIT SO2                   DISPOSAL COST/CREDIT CO
DISPOSAL COST/CREDIT PART   00001.00E 00  DISPOSAL COST/CREDIT OTHER                 DEVICE FUEL FACTOR       00000.00E 00
RATED EFF  SO2              00000.00E 00  RATED EFF  CO                00000.00E 00  RATED EFF  PART.         00099.00E 00
RATED EFF  OTHER
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                                              DEVICE FILE LISTING                                    MARCH 13, 1970

     REGION   INSTALLATION TEST CASE           DEVICE ID  019                    DESCRIPTIVE NAME  CATALITIC AFTERBURNER

  MFG'S PRICE COEFF.  #1      00007.55E 00   MFG'S PRICE COEFF.  #2      00015.15E-01   MFG'S PRICE COEFF.  #3
  TRANSPORTATION COST FACTOR                 ERECTION COST FACTOR                       A & E COST FACTOR
  AUX EQUIP COST FACTOR                      UTIL CONN. COST FACTOR                     START-UP COST FACTOR
  SPARE PARTS COST FACTOR                    LAND & BLDGS COST FACTOR                   TOTAL INST COST FACTOR        00100.00E 00
  LIFE                        00015.00E 00   PRESS. DROP                 00001.00E 00   LABOR QTY  SM PLANT           00000.25E 00
  LABOR QTY MED PLANT         00000.50E 00   LABOR QTY  LARGE PLANT      00001.00E 00   LABOR QTY  X-LARGE PLANT      00002.00E 00
  CHEM COST                                  DISPOSAL COST/CREDIT SO2                   DISPOSAL COST/CREDIT CO
  DISPOSAL COST/CREDIT PART                  DISPOSAL COST/CREDIT OTHER  00000.00E 00   DEVICE FUEL FACTOR            00000.49E 00
  RATED EFF  SO2              00000.00E 00   RATED EFF  CO               00090.00E 00   RATED EFF  PART.              00095.00E 00
  RATED EFF  OTHER

     REGION   INSTALLATION TEST CASE           DEVICE ID  020                    DESCRIPTIVE NAME  CATALYTIC AB WITH HE

  MFG'S PRICE COEFF.  #1      00007.55E 00   MFG'S PRICE COEFF.  #2      00015.15E-01   MFG'S PRICE COEFF.  #3
  TRANSPORTATION COST FACTOR                 ERECTION COST FACTOR                       A & E COST FACTOR
  AUX EQUIP COST FACTOR                      UTIL CONN. COST FACTOR                     START-UP COST FACTOR
  SPARE PARTS COST FACTOR                    LAND & BLDGS COST FACTOR                   TOTAL INST COST FACTOR        00200.00E 00
  LIFE                        00015.00E 00   PRESS. DROP                 00001.00E 00   LABOR QTY  SM PLANT           00000.25E 00
  LABOR QTY MED PLANT         00000.50E 00   LABOR QTY  LARGE PLANT      00001.00E 00   LABOR QTY  X-LARGE PLANT      00002.00E 00
  CHEM COST                                  DISPOSAL COST/CREDIT SO2                   DISPOSAL COST/CREDIT CO
  DISPOSAL COST/CREDIT PART                  DISPOSAL COST/CREDIT OTHER  00000.00E 00   DEVICE FUEL FACTOR            00002.45E-01
  RATED EFF  SO2              00000.00E 00   RATED EFF  CO               00090.00E 00   RATED EFF  PART.              00095.00E 00
  RATED EFF  OTHER
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                                            DEVICE FILE LISTING                                          MARCH 13, 1970

    REGION   INSTALLATION TEST CASE           DEVICE ID  021                  DESCRIPTIVE NAME  DIRECT FLAME AFTERBURNER
MFG'S PRICE COEFF.  #1        00057.13E-01    MFG'S PRICE COEFF.  #2       00011.74E-01    MFG'S PRICE COEFF.  #3
TRANSPORTATION COST FACTOR                    ERECTION COST FACTOR                         A & E COST FACTOR
AUX EQUIP COST FACTOR                         UTIL CONN. COST FACTOR                       START-UP COST FACTOR
SPARE PARTS COST FACTOR                       LAND & BLDGS COST FACTOR                     TOTAL INST COST FACTOR        00100.00E 00
LIFE                          00015.00E 00    PRESS. DROP                  00001.00E 00    LABOR QTY  SM PLANT           00001.25E-01
LABOR QTY MED PLANT           00000.25E 00    LABOR QTY  LARGE PLANT       00000.50E 00    LABOR QTY  X-LARGE PLANT      00001.00E 00
CHEM COST                                     DISPOSAL COST/CREDIT SO2                     DISPOSAL COST/CREDIT CO
DISPOSAL COST/CREDIT PART                     DISPOSAL COST/CREDIT OTHER   00000.00E 00    DEVICE FUEL FACTOR            00001.00E 00
RATED EFF  SO2                00000.00E 00    RATED EFF  CO                00090.00E 00    RATED EFF  PART.              00095.00E 00
RATED EFF  OTHER

    REGION   INSTALLATION TEST CASE           DEVICE ID  022                  DESCRIPTIVE NAME  DIRECT FLAME AB WITH HE
MFG'S PRICE COEFF.  #1        00057.13E-01    MFG'S PRICE COEFF.  #2       00011.74E-01    MFG'S PRICE COEFF.  #3
TRANSPORTATION COST FACTOR                    ERECTION COST FACTOR                         A & E COST FACTOR
AUX EQUIP COST FACTOR                         UTIL CONN. COST FACTOR                       START-UP COST FACTOR
SPARE PARTS COST FACTOR                       LAND & BLDGS COST FACTOR                     TOTAL INST COST FACTOR        00200.00E 00
LIFE                          00015.00E 00    PRESS. DROP                  00001.00E 00    LABOR QTY  SM PLANT           00001.25E-01
LABOR QTY MED PLANT           00000.25E 00    LABOR QTY  LARGE PLANT       00000.50E 00    LABOR QTY  X-LARGE PLANT      00001.00E 00
CHEM COST                                     DISPOSAL COST/CREDIT SO2                     DISPOSAL COST/CREDIT CO
DISPOSAL COST/CREDIT PART                     DISPOSAL COST/CREDIT OTHER   00000.00E 00    DEVICE FUEL FACTOR            00004.04E-01
RATED EFF  SO2                00000.00E 00    RATED EFF  CO                00090.00E 00    RATED EFF  PART.              00095.00E 00
RATED EFF  OTHER
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                                   DEVICE FILE LISTING                                          MARCH 13, 1970

 REGION  INSTALLATION TEST CASE          DEVICE ID  027                  DESCRIPTIVE NAME  FUEL CHANGE 2% S COAL

   MFG'S PRICE COEFF.  #1                  MFG'S PRICE COEFF.  #2                  MFG'S PRICE COEFF.  #3
   TRANSPORTATION COST FACTOR              ERECTION COST FACTOR                    A & E COST FACTOR
   AUX EQUIP COST FACTOR                   UTIL CONN. COST FACTOR                  START-UP COST FACTOR
   SPARE PARTS COST FACTOR                 LAND & BLDGS COST FACTOR                TOTAL INST COST FACTOR
   LIFE                                    PRESS. DROP                             LABOR QTY  SM PLANT
   LABOR QTY MED PLANT                     LABOR QTY  LARGE PLANT                  LABOR QTY  X-LARGE PLANT
   CHEM COST                               DISPOSAL COST/CREDIT SO2                DISPOSAL COST/CREDIT CO
   DISPOSAL COST/CREDIT PART               DISPOSAL COST/CREDIT OTHER              DEVICE FUEL FACTOR
   RATED EFF  SO2                          RATED EFF  CO                           RATED EFF  PART.
   RATED EFF  OTHER

 REGION  INSTALLATION TEST CASE          DEVICE ID  028                  DESCRIPTIVE NAME  FUEL CHANGE 1% S COAL

   MFG'S PRICE COEFF.  #1                  MFG'S PRICE COEFF.  #2                  MFG'S PRICE COEFF.  #3
   TRANSPORTATION COST FACTOR              ERECTION COST FACTOR                    A & E COST FACTOR
   AUX EQUIP COST FACTOR                   UTIL CONN. COST FACTOR                  START-UP COST FACTOR
   SPARE PARTS COST FACTOR                 LAND & BLDGS COST FACTOR                TOTAL INST COST FACTOR
   LIFE                                    PRESS. DROP                             LABOR QTY  SM PLANT
   LABOR QTY MED PLANT                     LABOR QTY  LARGE PLANT                  LABOR QTY  X-LARGE PLANT
   CHEM COST                               DISPOSAL COST/CREDIT SO2                DISPOSAL COST/CREDIT CO
   DISPOSAL COST/CREDIT PART               DISPOSAL COST/CREDIT OTHER              DEVICE FUEL FACTOR
   RATED EFF  SO2                          RATED EFF  CO                           RATED EFF  PART.
   RATED EFF  OTHER
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                                  DEVICE FILE LISTING                                          MARCH 13, 1970

 |  REGION  INSTALLATION TEST CASE          DEVICE ID  029                DESCRIPTIVE NAME  FUEL CHANGE 0.5% S COAL   |
   MFG'S PRICE COEFF.  #1                   MFG'S PRICE COEFF.  #2          MFG'S PRICE COEFF.  #3
   TRANSPORTATION COST FACTOR               ERECTION COST FACTOR            A & E COST FACTOR
   AUX EQUIP COST FACTOR                    UTIL CONN. COST FACTOR          START-UP COST FACTOR
   SPARE PARTS COST FACTOR                  LAND & BLDGS COST FACTOR        TOTAL INST COST FACTOR
   LIFE                                     PRESS. DROP                     LABOR QTY  SM PLANT
   LABOR QTY MED PLANT                      LABOR QTY  LARGE PLANT          LABOR QTY  X-LARGE PLANT
   CHEM COST                                DISPOSAL COST/CREDIT SO2        DISPOSAL COST/CREDIT CO
   DISPOSAL COST/CREDIT PART                DISPOSAL COST/CREDIT OTHER      DEVICE FUEL FACTOR
   RATED EFF  SO2                           RATED EFF  CO                   RATED EFF  PART.
   RATED EFF  OTHER

 |  REGION  INSTALLATION TEST CASE          DEVICE ID  030                DESCRIPTIVE NAME  FUEL CHANGE 2% S OIL      |
   MFG'S PRICE COEFF.  #1                   MFG'S PRICE COEFF.  #2          MFG'S PRICE COEFF.  #3
   TRANSPORTATION COST FACTOR               ERECTION COST FACTOR            A & E COST FACTOR
   AUX EQUIP COST FACTOR                    UTIL CONN. COST FACTOR          START-UP COST FACTOR
   SPARE PARTS COST FACTOR                  LAND & BLDGS COST FACTOR        TOTAL INST COST FACTOR
   LIFE                                     PRESS. DROP                     LABOR QTY  SM PLANT
   LABOR QTY MED PLANT                      LABOR QTY  LARGE PLANT          LABOR QTY  X-LARGE PLANT
   CHEM COST                                DISPOSAL COST/CREDIT SO2        DISPOSAL COST/CREDIT CO
   DISPOSAL COST/CREDIT PART                DISPOSAL COST/CREDIT OTHER      DEVICE FUEL FACTOR
   RATED EFF  SO2                           RATED EFF  CO                   RATED EFF  PART.
   RATED EFF  OTHER
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                                        DEVICE FILE LISTING                                          MARCH 13, 1970

   | REGION   INSTALLATION TEST CASE          DEVICE ID  031               DESCRIPTIVE NAME  FUEL CHANGE 1% S OIL      |
  MFG'S PRICE COEFF.  #1                   MFG'S PRICE COEFF.  #2                   MFG'S PRICE COEFF.  #3
  TRANSPORTATION COST FACTOR               ERECTION COST FACTOR                     A & E COST FACTOR
  AUX EQUIP COST FACTOR                    UTIL CONN. COST FACTOR                   START-UP COST FACTOR
  SPARE PARTS COST FACTOR                  LAND & BLDGS COST FACTOR                 TOTAL INST COST FACTOR
  LIFE                                     PRESS. DROP                              LABOR QTY  SM PLANT
  LABOR QTY MED PLANT                      LABOR QTY  LARGE PLANT                   LABOR QTY  X-LARGE PLANT
  CHEM COST                                DISPOSAL COST/CREDIT SO2                 DISPOSAL COST/CREDIT CO
  DISPOSAL COST/CREDIT PART                DISPOSAL COST/CREDIT OTHER               DEVICE FUEL FACTOR
  RATED EFF  SO2                           RATED EFF  CO                            RATED EFF  PART.
  RATED EFF  OTHER

   | REGION   INSTALLATION TEST CASE          DEVICE ID  032               DESCRIPTIVE NAME  FUEL CHANGE 0.5% S OIL    |
  MFG'S PRICE COEFF.  #1                   MFG'S PRICE COEFF.  #2                   MFG'S PRICE COEFF.  #3
  TRANSPORTATION COST FACTOR               ERECTION COST FACTOR                     A & E COST FACTOR
  AUX EQUIP COST FACTOR                    UTIL CONN. COST FACTOR                   START-UP COST FACTOR
  SPARE PARTS COST FACTOR                  LAND & BLDGS COST FACTOR                 TOTAL INST COST FACTOR
  LIFE                                     PRESS. DROP                              LABOR QTY  SM PLANT
  LABOR QTY MED PLANT                      LABOR QTY  LARGE PLANT                   LABOR QTY  X-LARGE PLANT
  CHEM COST                                DISPOSAL COST/CREDIT SO2                 DISPOSAL COST/CREDIT CO
  DISPOSAL COST/CREDIT PART                DISPOSAL COST/CREDIT OTHER               DEVICE FUEL FACTOR
  RATED EFF  SO2                           RATED EFF  CO                            RATED EFF  PART.
  RATED EFF  OTHER
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    REGION   INSTALLATION TEST CASE           DEVICE ID  033                    DESCRIPTIVE NAME  FUEL CHANGE GAS
 MFG'S PRICE COEFF.  #1                       MFG'S PRICE COEFF.  #2                      MFG'S PRICE COEFF.  #3
 TRANSPORTATION COST FACTOR                   ERECTION COST FACTOR                        A & E COST FACTOR
 AUX EQUIP COST FACTOR                        UTIL CONN. COST FACTOR                      START-UP COST FACTOR
 SPARE PARTS COST FACTOL                      LAND & BLDGS COST FACTOR                    TOTAL INST COST FACTOR
 LIFE                                         PRESS. DROP                                 LABOR QTY  SM PLANT
 LABOR QTY MED PLANT                          LABOR QTY  LARGE PLANT                      LABOR QTY  X-LARGE PLANT
 CHEM COST                                    DISPOSAL COST/CREDIT SO2                    DISPOSAL COST/CREDIT CO
 DISPOSAL COST/CREDIT PART                    DISPOSAL COST/CREDIT OTHER                  DEVICE FUEL FACTOR
 RATED EFF  SO2                               RATED EFF  CO                               RATED EFF  PART.
 RATED EFF  OTHER

    REGION   INSTALLATION TEST CASE           DEVICE ID  039                    DESCRIPTIVE NAME  CATALYTIC OXIDATION
 MFG'S PRICE COEFF.  #1      -00012.41E 00    MFG'S PRICE COEFF.  #2      00001.67E 00    MFG'S PRICE COEFF.  #3       00000.00E 00
 TRANSPORTATION COST FACTOR                   ERECTION COST FACTOR                        A & E COST FACTOR
 AUX EQUIP COST FACTOR                        UTIL CONN. COST FACTOR                      START-UP COST FACTOR
 SPARE PARTS COST FACTOR                      LAND & BLDGS COST FACTOR                    TOTAL INST COST FACTOR       00000.00E 00
 LIFE                         00015.00E 00    PRESS. DROP                 00041.50E 00    LABOR QTY  SM PLANT
 LABOR QTY MED PLANT                          LABOR QTY  LARGE PLANT                      LABOR QTY  X-LARGE PLANT
 CHEM COST                                    DISPOSAL COST/CREDIT SO2   -00027.60E 00    DISPOSAL COST/CREDIT CO
 DISPOSAL COST/CREDIT PART                    DISPOSAL COST/CREDIT OTHER                  DEVICE FUEL FACTOR           00000.00E 00
 RATED EFF  SO2               00090.00E 00    RATED EFF  CO               00000.00E 00    RATED EFF  PART.             00000.00E 00
 RATED EFF  OTHER
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    REGION   INSTALLATION TEST CASE          DEVICE ID  040                  DESCRIPTIVE NAME  ALKALIZED ALUMINA
 MFG'S PRICE COEFF.  #1      .00000.00E 00   MFG'S PRICE COEFF.  #2        00021.70E-07   MFG'S PRICE COEFF.  #3     00002.60E-17
 TRANSPORTATION COST FACTOR                  ERECTION COST FACTOR                         A & E COST FACTOR
 AUX EQUIP COST FACTOR                       UTIL CONN. COST FACTOR                       START-UP COST FACTOR
 SPARE PARTS COST FACTOR                     LAND & BLDGS COST FACTOR                     TOTAL INST COST FACTOR     00000.00E 00
 LIFE                        00015.00E 00    PRESS. DROP                                  LABOR QTY  SM PLANT
 LABOR QTY MED PLANT                         LABOR QTY  LARGE PLANT                       LABOR QTY  X-LARGE PLANT
 CHEM COST                                   DISPOSAL COST/CREDIT SO2                     DISPOSAL COST/CREDIT CO
 DISPOSAL COST/CREDIT PART                   DISPOSAL COST/CREDIT OTHER                   DEVICE FUEL FACTOR         00000.00E 00
 RATED EFF  SO2              00080.00E 00    RATED EFF  CO                 00000.00E 00   RATED EFF  PART.           00000.00E 00
 RATED EFF  OTHER

    REGION   INSTALLATION TEST CASE          DEVICE ID  041                  DESCRIPTIVE NAME  DRY LIMESTONE INJECTION
 MFG'S PRICE COEFF.  #1       00000.00E 00   MFG'S PRICE COEFF.  #2        00009.95E-07   MFG'S PRICE COEFF.  #3     00006.03E-17
 TRANSPORTATION COST FACTOR                  ERECTION COST FACTOR                         A & E COST FACTOR
 AUX EQUIP COST FACTOR                       UTIL CONN. COST FACTOR                       START-UP COST FACTOR
 SPARE PARTS COST FACTOR                     LAND & BLDGS COST FACTOR                     TOTAL INST COST FACTOR     00000.00E 00
 LIFE                        00015.00E 00    PRESS. DROP                                  LABOR QTY  SM PLANT
 LABOR QTY MED PLANT                         LABOR QTY  LARGE PLANT                       LABOR QTY  X-LARGE PLANT
 CHEM COST                   00002.00E 00    DISPOSAL COST/CREDIT SO2                     DISPOSAL COST/CREDIT CO
 DISPOSAL COST/CREDIT PART                   DISPOSAL COST/CREDIT OTHER                   DEVICE FUEL FACTOR         00000.00E 00
 RATED EFF  SO2              00050.00E 00    RATED EFF  CO                 00000.00E 00   RATED EFF  PART.           00000.00E 00
 RATED EFF  OTHER
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                                        DEVICE FILE LISTING                                       MARCH 13, 1970

   |  REGION   INSTALLATION TEST CASE           DEVICE ID  042                 DESCRIPTIVE NAME  WET LIMESTONE INJECTION  |
   MFG'S PRICE COEFF.  #1      00000.00E 00    MFG'S PRICE COEFF.  #2      00014.35E-07    MFG'S PRICE COEFF.  #3      00005.20E-17
   TRANSPORTATION COST FACTOR                  ERECTION COST FACTOR                        A & E COST FACTOR
   AUX EQUIP COST FACTOR                       UTIL CONN. COST FACTOR                      START-UP COST FACTOR
   SPARE PARTS COST FACTOR                     LAND & BLDGS COST FACTOR                    TOTAL INST COST FACTOR      00000.00E 00
   LIFE                        00015.00E 00    PRESS. DROP                                 LABOR QTY  SM PLANT
   LABOR QTY MED PLANT                         LABOR QTY  LARGE PLANT                      LABOR QTY  X-LARGE PLANT
   CHEM COST                   00002.00E 00    DISPOSAL COST/CREDIT SO2                    DISPOSAL COST/CREDIT CO
   DISPOSAL COST/CREDIT PART                   DISPOSAL COST/CREDIT OTHER                  DEVICE FUEL FACTOR          00000.00E 00
   RATED EFF  SO2              00080.00E 00    RATED EFF  CO               00000.00E 00    RATED EFF  PART.            00098.00E 00
   RATED EFF  OTHER

   |  REGION   INSTALLATION TEST CASE           DEVICE ID  043                 DESCRIPTIVE NAME  H2SO4 PLANT-CONTACT      |
   MFG'S PRICE COEFF.  #1      00000.00E 00    MFG'S PRICE COEFF.  #2      00000.80E 00    MFG'S PRICE COEFF.  #3
   TRANSPORTATION COST FACTOR                  ERECTION COST FACTOR                        A & E COST FACTOR
   AUX EQUIP COST FACTOR                       UTIL CONN. COST FACTOR                      START-UP COST FACTOR
   SPARE PARTS COST FACTOR                     LAND & BLDGS COST FACTOR                    TOTAL INST COST FACTOR      00000.00E 00
   LIFE                        00020.00E 00    PRESS. DROP                                 LABOR QTY  SM PLANT
   LABOR QTY MED PLANT                         LABOR QTY  LARGE PLANT                      LABOR QTY  X-LARGE PLANT
   CHEM COST                                   DISPOSAL COST/CREDIT SO2   -00027.60E 00    DISPOSAL COST/CREDIT CO
   DISPOSAL COST/CREDIT PART                   DISPOSAL COST/CREDIT OTHER                  DEVICE FUEL FACTOR          00000.00E 00
   RATED EFF  SO2              00097.50E 00    RATED EFF  CO               00000.00E 00    RATED EFF  PART.            00000.00E 00
   RATED EFF  OTHER
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                                        DEVICE FILE LISTING                                              MARCH 13, 1970

    REGION   INSTALLATION TEST CASE             DEVICE ID  044                    DESCRIPTIVE NAME  H2SO4 PLANT-2 CONTACT
MFG'S PRICE COEFF.  #1        00000.00E 00     MFG'S PRICE COEFF.  #2        00000.80E 00     MFG'S PRICE COEFF.  #3
TRANSPORTATION COST FACTOR                     ERECTION COST FACTOR                           A & E COST FACTOR
AUX EQUIP COST FACTOR                          UTIL CONN. COST FACTOR                         START-UP COST FACTOR
SPARE PARTS COST FACTOR                        LAND & BLDGS COST FACTOR                       TOTAL INST COST FACTOR       00000.00E 00
LIFE                          00020.00E 00     PRESS. DROP                                    LABOR QTY  SM PLANT
LABOR QTY MED PLANT                            LABOR QTY  LARGE PLANT                         LABOR QTY  X-LARGE PLANT
CHEM COST                                      DISPOSAL COST/CREDIT SO2     -00027.60E 00     DISPOSAL COST/CREDIT CO
DISPOSAL COST/CREDIT PART                      DISPOSAL COST/CREDIT OTHER                     DEVICE FUEL FACTOR           00000.00E 00
RATED EFF  SO2                00099.50E 00     RATED EFF  CO                 00000.00E 00     RATED EFF  PART.             00000.00E 00
RATED EFF  OTHER

    REGION   INSTALLATION TEST CASE             DEVICE ID  045                    DESCRIPTIVE NAME  SULFUR PLANT
MFG'S PRICE COEFF.  #1        00000.00E 00     MFG'S PRICE COEFF.  #2        00000.81E 00     MFG'S PRICE COEFF.  #3
TRANSPORTATION COST FACTOR                     ERECTION COST FACTOR                           A & E COST FACTOR
AUX EQUIP COST FACTOR                          UTIL CONN. COST FACTOR                         START-UP COST FACTOR
SPARE PARTS COST FACTOR                        LAND & BLDGS COST FACTOR                       TOTAL INST COST FACTOR       00000.00E 00
LIFE                          00020.00E 00     PRESS. DROP                                    LABOR QTY  SM PLANT
LABOR QTY MED PLANT                            LABOR QTY  LARGE PLANT                         LABOR QTY  X-LARGE PLANT
CHEM COST                                      DISPOSAL COST/CREDIT SO2     -00015.00E 00     DISPOSAL COST/CREDIT CO
DISPOSAL COST/CREDIT PART                      DISPOSAL COST/CREDIT OTHER                     DEVICE FUEL FACTOR           00000.00E 00
RATED EFF  SO2                00095.00E 00     RATED EFF  CO                 00000.00E 00     RATED EFF  PART.             00000.00E 00
RATED EFF  OTHER
```

Figure 9-11.

```
------------------------------------------------------------------------------------
                    REGION    FILE
                          INPUT
------------------------------------------------------------------------------------

------------------------------------------------------------------------------------
   000        001     3.  E
   907        005     8.5 E   006     9.0 E   007     6.0 E   008    10.0 E
   907        001     2.59E   002     0.0 E   003     0.0 E   004     0.0 E
   9C7        033     0.0 E   034     7.0 E   035     7.0 E   036     7.0 E
   907        029     0.5 E   030     2.0 E   031     1.0 E   032     0.5 E
   907        025   152.   E+03026 1000.   E  027     2.0 E   028     1.0 E
   907        021    27.   E+06022   29.  E+06023 152.  E+03024  152.  E+03
   907        017     6.10E-02018     0.55E-03019     0.44E-03020   27.  E+06
   907        013    55.25E-03014     6.9 E-02015     5.71E-02016     7.36E-02
   907        009     6.4 E   010    11.95E   011     8.0 E   012     6.67E-02
------------------------------------------------------------------------------------
                    END INPUT LIST
------------------------------------------------------------------------------------
```

Figure 9-12.

```
                              REGION    FILE
                         DICTIONARY    LISTING
 001  LABOR COST                   $/HR                      N   2.00E 00 5.00E 00
 002  SALES TAX   A                PERCENTAGE                N   0.00E 00 1.00E 01
 003  SALES TAX   B                PERCENTAGE                N   0.00E 00 1.00E 01
 004  SALES TAX   C                PERCENTAGE                N   0.00E 00 1.00E 01
 005  INTEREST RATE                PERCENTAGE                N   0.00E 00 1.50E 01
 006  COAL A  COST  INDUSTRIAL     $/TON                     N   1.00E 00 1.50E 01
 007  COAL A  COST  POWER PLANT    $/TON                     N   1.00E 00 1.50E 01
 008  COAL B  COST  INDUSTRIAL     $/TON                     N   1.00E 00 1.50E 01
 009  COAL B  COST  POWER PLANT    $/TON                     N   1.00E 00 1.50E 01
 010  COAL C  COST  INDUSTRIAL     $/TON                     N   1.00E 00 1.50E 01
 011  COAL C  COST  POWER PLANT    $/TON                     N   1.00E 00 1.50E 01
 012  OIL A   COST  INDUSTRIAL     $/GAL                     N   1.00E-02 2.00E-01
 013  OIL A   COST  POWER PLANT    $/GAL                     N   1.00E-02 2.00E-01
 014  OIL B   COST  INDUSTRIAL     $/GAL                     N   1.00E-02 2.00E-01
 015  OIL B   COST  POWER PLANT    $/GAL                     N   1.00E-02 2.00E-01
 016  OIL C   COST  INDUSTRIAL     $/GAL                     N   1.00E-02 2.00E-01
 017  OIL C   COST  POWER PLANT    $/GAL                     N   1.00E-02 2.00E-01
 018  GAS COST  INDUSTRIAL         $/CU.FT                   N   1.00E-04 1.50E-03
 019  GAS COST  POWER PLANT        $/CU.FT                   N   1.00E-04 1.50E-03
 020  COAL A  HEAT CONTENT         BTU/TON                   N   1.00E 07 3.50E 07
 021  COAL B  HEAT CONTENT         BTU/TON                   N   1.00E 07 3.50E 07
 022  COAL C  HEAT CONTENT         BTU/TON                   N   1.00E 07 3.50E 07
 023  OIL A   HEAT CONTENT         BTU/GAL                   N   1.00E 05 2.00E 05
 024  OIL B   HEAT CONTENT         BTU/GAL                   N   1.00E 05 2.00E 05
 025  OIL C   HEAT CONTENT         BTU/GAL                   N   1.00E 05 2.00E 05
 026  GAS HEAT CONTENT             BTU/CU.FT                 N   1.00E 02 1.20E 03
 027  COAL A  SULPHUR CONTENT      PERCENTAGE                N   3.00E-01 3.00E 00
 028  COAL B  SULPHUR CONTENT      PERCENTAGE                N   3.00E-01 3.00E 00
 029  COAL C  SULPHUR CONTENT      PERCENTAGE                N   3.00E-01 3.00E 00
 030  OIL A   SULPHUR CONTENT      PERCENTAGE                N   3.00E-01 3.00E 00
 031  OIL B   SULPHUR CONTENT      PERCENTAGE                N   3.00E-01 3.00E 00
 032  OIL C   SULPHUR CONTENT      PERCENTAGE                N   3.00E-01 3.00E 00
 033  GAS SULPHUR CONTENT          PERCENTAGE                N   0.00E 00 1.00E 00
 034  COAL A  ASH CONTENT          PERCENTAGE                N   1.00E 00 2.00E 01
 035  COAL B  ASH CONTENT          PERCENTAGE                N   1.00E 00 2.00E 01
 036  COAL C  ASH CONTENT          PERCENTAGE                N   1.00E 00 2.00E 01
```

Figure 9-13.

```
   REGION    FILE
EDIT ERROR LISTING

   END ERROR LIST

   EDIT  SUMMARY

CARDS IN            10
CARDS REJECTED       0
CARD RECORDS OUT    10
```

Figure 9-14.

```
                 REGION FILE

        UPDATE AND MAINTENANCE SUMMARY

MASTER FILE RECORDS READ IN                     0

TRANSACTION FILE RECORDS READ IN               10

MASTER FILE RECORDS OVERLAYED                   0

MASTER FILE RECORDS INSERTED                    2

MASTER FILE RECORDS DELETED                     0

RECORDS ON NEW MASTER FILE                      2
```

```
                                          REGION FILE LISTING                                   FEBRUARY 27, 1970

   I    REGION    INSTALLATION TEST CASE                                                                          I
LABOR COST                  00002.59E 00   SALES TAX   A              00000.00E 00   SALES TAX   B              00000.00E 00
SALES TAX   C               00000.00E 00   INTEREST RATE              00008.50E 00   COAL A  COST  INDUSTRIAL   00009.00E 00
COAL A  COST  POWER PLANT   00006.00E 00   COAL B  COST  INDUSTRIAL   00010.00E 00   COAL B  COST  POWER PLANT  00006.40E 00
COAL C  COST  INDUSTRIAL    00011.95E 00   COAL C  COST  POWER PLANT  00008.00E 00   OIL A   COST  INDUSTRIAL   00006.67E-02
OIL A   COST  POWER PLANT   00055.25E-03   OIL B   COST  INDUSTRIAL   00006.90E-02   OIL B   COST  POWER PLANT  00005.71E-02
OIL C   COST  INDUSTRIAL    00007.36E-02   OIL C   COST  POWER PLANT  00006.10E-02   GAS COST  INDUSTRIAL       00000.55E-03
GAS COST  POWER PLANT       00000.44E-03   COAL A  HEAT CONTENT       00027.00E+06   COAL B  HEAT CONTENT       00027.00E+06
COAL C  HEAT CONTENT        00029.00E+06   OIL A   HEAT CONTENT       00152.00E+03   OIL B   HEAT CONTENT       00152.00E+03
OIL C   HEAT CONTENT        00152.00E+03   GAS HEAT CONTENT           01000.00E 00   COAL A  SULPHUR CONTENT    00002.00E 00
COAL B  SULPHUR CONTENT     00001.00E 00   COAL C  SULPHUR CONTENT    00000.50E 00   OIL A   SULPHUR CONTENT    00002.00E 00
OIL B   SULPHUR CONTENT     00001.00E 00   OIL C   SULPHUR CONTENT    00000.50E 00   GAS SULPHUR CONTENT        00000.00E 00
COAL A  ASH CONTENT         00007.00E 00   COAL B  ASH CONTENT        00007.00E 00   COAL C  ASH CONTENT        00007.00E 00
```

Figure 9-15.

SOURCE LOCATION DATA

REGION :INSTALLATION TEST CASE

AREA SOURCE COORDINATES LOCATE CENTROID

SOURCE NUMBER	SIC CODE	SITE CODE	SOURCE LOCATIONS IN KILOMETERS HORIZONTAL	VERTICAL	SOURCE AREA IN SQ. KM	STACK HEIGHT IN METERS	STACK DIAMETER IN METERS
1	2800	410	88.0	71.0	0.0	24.0	2.56
2	2819	330	88.3	63.8	0.0	24.0	2.50
3	2819	331	88.3	63.8	0.0	30.0	1.86
4	2819	340	80.8	57.0	0.0	24.0	2.20
5	2819	341	80.8	57.0	0.0	30.0	1.86
6	2819	1602	71.5	31.7	0.0	23.0	2.10
7	2871	2601	90.3	70.0	0.0	18.0	2.06
8	2911	611	97.3	90.5	0.0	30.0	7.36
9	2951	1501	68.0	54.3	0.0	18.0	0.96
10	3241	1001	85.2	78.9	0.0	61.0	3.44
11	3295	511	83.1	91.2	0.0	12.0	0.21
12	3312	1111	92.1	74.2	0.0	30.0	4.54
13	3312	1112	92.1	74.2	0.0	30.0	5.35
14	3312	1113	92.1	74.2	0.0	30.0	3.60
15	3323	710	89.6	73.9	0.0	31.0	2.18
16	3323	721	89.8	74.5	0.0	30.0	0.46
17	3332	2701	71.8	26.4	0.0	30.0	3.22
18	3332	2703	71.8	26.4	0.0	30.0	0.74
19	3742	2400	84.4	75.8	0.0	23.0	0.80
20	4911	50	75.2	99.0	0.0	121.0	6.72
21	4911	60	130.0	84.5	0.0	121.0	0.92
22	4911	70	76.9	4.2	0.0	121.0	10.30
23	4953	1301	86.8	72.0	0.0	46.0	2.92
24	9999	10	34.8	89.7	707.40	0.0	0.0
25	9999	20	58.0	89.7	707.40	0.0	0.0
26	9999	30	75.4	97.0	176.80	0.0	0.0
27	9999	40	87.0	97.0	176.80	0.0	0.0
28	9999	50	98.6	97.0	176.80	0.0	0.0
29	9999	60	110.2	97.0	176.80	0.0	0.0
30	9999	70	127.6	89.7	707.40	0.0	0.0
31	9999	80	75.4	82.4	176.80	0.0	0.0
32	9999	90	87.0	82.4	176.80	0.0	0.0
33	9999	100	98.6	82.4	176.80	0.0	0.0
34	9999	110	110.2	82.4	176.80	0.0	0.0
35	9999	120	11.6	60.5	707.40	0.0	0.0
36	9999	130	34.8	60.5	707.40	0.0	0.0
37	9999	140	58.0	60.5	707.40	0.0	0.0
38	9999	150	75.4	67.8	176.80	0.0	0.0
39	9999	160	87.0	67.8	176.80	0.0	0.0
40	9999	170	98.6	67.8	176.80	0.0	0.0

S O U R C E   L O C A T I O N   D A T A

REGION :INSTALLATION TEST CASE

AREA SOURCE COORDINATES LOCATE CENTROID

SOURCE NUMBER	SIC CODE	SITE CODE	SOURCE LOCATIONS IN KILOMETERS HORIZONTAL	VERTICAL	SOURCE AREA IN SQ. KM	STACK HEIGHT IN METERS	STACK DIAMETER IN METERS
41	9999	180	110.2	67.8	176.80	0.0	0.0
42	9999	190	127.6	60.5	707.40	0.0	0.0
43	9999	200	75.4	53.2	176.80	0.0	0.0
44	9999	210	87.0	53.2	176.80	0.0	0.0
45	9999	220	98.6	53.2	176.80	0.0	0.0
46	9999	230	110.2	53.2	176.80	0.0	0.0
47	9999	240	11.6	31.3	707.40	0.0	0.0
48	9999	250	34.8	31.3	707.40	0.0	0.0
49	9999	260	58.0	31.3	707.40	0.0	0.0
50	9999	270	81.2	31.3	707.40	0.0	0.0
51	9999	280	104.4	31.3	707.40	0.0	0.0
52	9999	290	127.6	31.3	707.40	0.0	0.0

Figure 9-16.

SOURCE EMISSION DATA

REGION :INSTALLATION TEST CASE

SOURCE NUMBER	SUMMER SOX (TONS PER DAY)	SUMMER CO	SUMMER PART	WINTER SOX (TONS PER DAY)	WINTER CO	WINTER PART	ANNUAL SOX (TONS PER DAY)	ANNUAL CO	ANNUAL PART	EXIT VEL. (M/SEC)	STACK TEMP. (DEG-K)
1	21.39	0.0	4.09	33.79	0.0	6.47	26.74	0.0	5.12	17.8	483.0
2	31.69	0.0	19.26	31.69	0.0	19.26	31.69	0.0	19.26	17.8	489.0
3	19.10	0.0	0.26	19.10	0.0	0.26	19.10	0.0	0.26	15.2	362.0
4	20.36	0.0	3.90	20.36	0.0	3.90	20.36	0.0	3.90	17.8	500.0
5	23.70	0.0	0.21	23.70	0.0	0.21	23.70	0.0	0.21	15.2	361.0
6	0.0	0.0	21.90	0.0	0.0	21.90	0.0	0.0	21.90	15.2	505.0
7	0.0	0.0	8.00	0.0	0.0	8.00	0.0	0.0	8.00	15.2	325.0
8	0.0	521.00	0.12	0.0	521.00	0.12	0.0	521.00	0.12	15.2	811.0
9	0.0	0.0	1.95	0.0	0.0	0.0	0.0	0.0	0.97	17.8	394.0
10	0.0	0.0	2.79	0.0	0.0	2.79	0.0	0.0	2.79	15.2	561.0
11	0.0	0.0	19.18	0.0	0.0	19.18	0.0	0.0	19.18	17.8	294.0
12	0.0	0.0	1.00	0.0	0.0	1.00	0.0	0.0	1.00	17.8	477.0
13	0.0	0.0	0.74	0.0	0.0	0.74	0.0	0.0	0.74	17.8	527.0
14	0.23	0.0	0.27	0.23	0.0	0.27	0.23	0.0	0.27	17.8	444.0
15	6.19	0.0	0.59	6.19	0.0	0.59	6.19	0.0	0.59	15.2	505.0
16	0.92	0.0	1.01	0.92	0.0	1.01	0.92	0.0	1.01	17.8	450.0
17	203.00	0.0	0.31	203.00	0.0	0.31	203.00	0.0	0.31	17.8	783.0
18	28.20	0.0	0.02	28.20	0.0	0.02	28.20	0.0	0.02	17.8	783.0
19	1.28	0.0	0.98	2.02	0.0	1.54	1.60	0.0	1.22	15.2	564.0
20	192.08	0.0	1.97	192.08	0.0	1.97	192.08	0.0	1.97	15.2	439.0
21	3.59	0.0	4.58	3.59	0.0	4.58	3.59	0.0	4.58	15.2	444.0
22	419.00	0.0	13.45	382.40	0.0	12.25	377.20	0.0	12.09	15.2	427.0
23	0.30	0.15	2.55	0.30	0.15	2.55	0.30	0.15	2.55	15.2	533.0
24	0.0	0.0	0.0	0.0	0.0	0.0	0.24	0.0	0.07	0.0	0.0
25	0.0	0.0	0.0	0.0	0.0	0.0	0.48	0.0	0.40	0.0	0.0
26	0.0	0.0	0.0	0.0	0.0	0.0	0.11	0.0	0.05	0.0	0.0
27	0.0	0.0	0.0	0.0	0.0	0.0	1.30	0.0	0.48	0.0	0.0
28	0.0	0.0	0.0	0.0	0.0	0.0	3.85	0.0	0.81	0.0	0.0
29	0.0	0.0	0.0	0.0	0.0	0.0	0.17	0.0	0.04	0.0	0.0
30	0.0	0.0	0.0	0.0	0.0	0.0	0.58	0.0	0.12	0.0	0.0
31	0.0	0.0	0.0	0.0	0.0	0.0	2.54	0.0	0.56	0.0	0.0
32	0.0	0.0	0.0	0.0	0.0	0.0	3.00	0.0	0.76	0.0	0.0
33	0.0	0.0	0.0	0.0	0.0	0.0	0.46	0.0	0.11	0.0	0.0
34	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
35	0.0	0.0	0.0	0.0	0.0	0.0	0.01	0.0	0.01	0.0	0.0
36	0.0	0.0	0.0	0.0	0.0	0.0	1.03	0.0	0.44	0.0	0.0
37	0.0	0.0	0.0	0.0	0.0	0.0	1.34	0.0	0.33	0.0	0.0
38	0.0	0.0	0.0	0.0	0.0	0.0	16.48	0.0	3.96	0.0	0.0
39	0.0	0.0	0.0	0.0	0.0	0.0	32.75	0.0	9.00	0.0	0.0
40	0.0	0.0	0.0	0.0	0.0	0.0	8.60	0.0	2.16	0.0	0.0

SOURCE EMISSION DATA

REGION :INSTALLATION TEST CASE

SOURCE NUMBER	SUMMER			WINTER			ANNUAL			EXIT	STACK
	SOX (TONS PER DAY)	CO	PART	SOX (TONS PER DAY)	CO	PART	SOX (TONS PER DAY)	CO	PART	VEL. (M/SEC)	TEMP. (DEG-K)
41	0.0	0.0	0.0	0.0	0.0	0.0	1.22	0.0	0.22	0.0	0.0
42	0.0	0.0	0.0	0.0	0.0	0.0	0.78	0.0	0.15	0.0	0.0
43	0.0	0.0	0.0	0.0	0.0	0.0	0.92	0.0	0.20	0.0	0.0
44	0.0	0.0	0.0	0.0	0.0	0.0	2.37	0.0	2.02	0.0	0.0
45	0.0	0.0	0.0	0.0	0.0	0.0	1.20	0.0	0.69	0.0	0.0
46	0.0	0.0	0.0	0.0	0.0	0.0	2.83	0.0	0.50	0.0	0.0
47	0.0	0.0	0.0	0.0	0.0	0.0	0.01	0.0	0.01	0.0	0.0
48	0.0	0.0	0.0	0.0	0.0	0.0	0.77	0.0	0.16	0.0	0.0
49	0.0	0.0	0.0	0.0	0.0	0.0	0.63	0.0	0.14	0.0	0.0
50	0.0	0.0	0.0	0.0	0.0	0.0	0.54	0.0	0.09	0.0	0.0
51	0.0	0.0	0.0	0.0	0.0	0.0	0.23	0.0	0.06	0.0	0.0
52	0.0	0.0	0.0	0.0	0.0	0.0	0.38	0.0	0.06	0.0	0.0

Figure 9-17.

METEOROLOGICAL INPUT DATA FOR THE ANNUAL SEASON

STABILITY CLASS 1

	WINDSPEED CLASS					
WIND DIRECTION	1	2	3	4	5	6
N	0.0	0.0	0.0	0.0	0.0	0.0
NNE	0.0	0.0	0.0	0.0	0.0	0.0
NE	0.0	0.0	0.0	0.0	0.0	0.0
ENE	0.0	0.0	0.0	0.0	0.0	0.0
E	0.0	0.0	0.0	0.0	0.0	0.0
ESE	0.0	0.0	0.0	0.0	0.0	0.0
SE	0.0	0.0	0.0	0.0	0.0	0.0
SSE	0.0	0.0	0.0	0.0	0.0	0.0
S	0.0	0.0	0.0	0.0	0.0	0.0
SSW	0.0	0.0	0.0	0.0	0.0	0.0
SW	0.0	0.0	0.0	0.0	0.0	0.0
WSW	0.0	0.0	0.0	0.0	0.0	0.0
W	0.0	0.0	0.0	0.0	0.0	0.0
WNW	0.0	0.0	0.0	0.0	0.0	0.0
NW	0.0	0.0	0.0	0.0	0.0	0.0
NNW	0.0	0.0	0.0	0.0	0.0	0.0

METEOROLOGICAL INPUT DATA FOR THE ANNUAL SEASON

STABILITY CLASS 2

	WINDSPEED CLASS					
WIND DIRECTION	1	2	3	4	5	6
N	0.0005	0.0005	0.0	0.0	0.0	0.0
NNE	0.0	0.0	0.0	0.0	0.0	0.0
NE	0.0	0.0005	0.0	0.0	0.0	0.0
ENE	0.0005	0.0	0.0	0.0	0.0	0.0
E	0.0009	0.0005	0.0005	0.0	0.0	0.0
ESE	0.0009	0.0	0.0	0.0	0.0	0.0
SE	0.0009	0.0005	0.0	0.0	0.0	0.0
SSE	0.0	0.0	0.0	0.0	0.0	0.0
S	0.0	0.0	0.0	0.0	0.0	0.0
SSW	0.0	0.0	0.0	0.0	0.0	0.0
SW	0.0	0.0	0.0	0.0	0.0	0.0
WSW	0.0009	0.0	0.0	0.0	0.0	0.0
W	0.0	0.0005	0.0	0.0	0.0	0.0
WNW	0.0005	0.0	0.0	0.0	0.0	0.0
NW	0.0	0.0	0.0	0.0	0.0	0.0
NNW	0.0	0.0	0.0	0.0	0.0	0.0

METEOROLOGICAL INPUT DATA FOR THE ANNUAL SEASON

STABILITY CLASS 3

	WINDSPEED CLASS					
WIND DIRECTION	1	2	3	4	5	6
N	0.0005	0.0	0.0032	0.0	0.0	0.0
NNE	0.0	0.0005	0.0009	0.0	0.0	0.0
NE	0.0	0.0	0.0009	0.0	0.0	0.0
ENE	0.0009	0.0009	0.0046	0.0	0.0	0.0
E	0.0018	0.0028	0.0041	0.0005	0.0	0.0
ESE	0.0	0.0037	0.0046	0.0	0.0	0.0
SE	0.0014	0.0032	0.0028	0.0	0.0	0.0
SSE	0.0	0.0028	0.0009	0.0	0.0	0.0
S	0.0	0.0009	0.0009	0.0	0.0	0.0
SSW	0.0	0.0018	0.0009	0.0	0.0	0.0
SW	0.0	0.0018	0.0009	0.0	0.0	0.0
WSW	0.0005	0.0014	0.0009	0.0	0.0	0.0
W	0.0	0.0014	0.0009	0.0	0.0	0.0
WNW	0.0005	0.0005	0.0009	0.0	0.0	0.0
NW	0.0	0.0009	0.0005	0.0	0.0	0.0
NNW	0.0	0.0014	0.0014	0.0	0.0	0.0

METEOROLOGICAL INPUT DATA FOR THE ANNUAL SEASON

STABILITY CLASS 4

WIND DIRECTION	WINDSPEED CLASS 1	2	3	4	5	6
N	0.0	0.0018	0.0526	0.0383	0.0037	0.0
NNE	0.0	0.0009	0.0134	0.0157	0.0028	0.0
NE	0.0	0.0009	0.0106	0.0148	0.0005	0.0
ENE	0.0	0.0037	0.0106	0.0106	0.0005	0.0
E	0.0	0.0056	0.0148	0.0138	0.0055	0.0014
ESE	0.0	0.0028	0.0101	0.0507	0.0111	0.0014
SE	0.0	0.0014	0.0217	0.0410	0.0051	0.0005
SSE	0.0	0.0018	0.0175	0.0244	0.0028	0.0
S	0.0	0.0005	0.0148	0.0300	0.0023	0.0
SSW	0.0	0.0014	0.0088	0.0088	0.0	0.0
SW	0.0	0.0018	0.0018	0.0	0.0	0.0
WSW	0.0	0.0009	0.0088	0.0005	0.0	0.0
W	0.0	0.0041	0.0129	0.0069	0.0	0.0
WNW	0.0	0.0037	0.0157	0.0111	0.0018	0.0
NW	0.0	0.0023	0.0244	0.0161	0.0028	0.0
NNW	0.0	0.0028	0.0300	0.0327	0.0023	0.0

METEOROLOGICAL INPUT DATA FOR THE ANNUAL SEASON

STABILITY CLASS 5

	WINDSPEED CLASS					
WIND DIRECTION	1	2	3	4	5	6
N	0.0051	0.0124	0.0212	0.0	0.0	0.0
NNE	0.0005	0.0028	0.0046	0.0	0.0	0.0
NE	0.0009	0.0051	0.0028	0.0	0.0	0.0
ENE	0.0032	0.0078	0.0041	0.0	0.0	0.0
E	0.0106	0.0161	0.0055	0.0	0.0	0.0
ESE	0.0055	0.0161	0.0124	0.0	0.0	0.0
SE	0.0014	0.0069	0.0046	0.0	0.0	0.0
SSE	0.0009	0.0051	0.0051	0.0	0.0	0.0
S	0.0028	0.0046	0.0023	0.0	0.0	0.0
SSW	0.0051	0.0065	0.0	0.0	0.0	0.0
SW	0.0009	0.0037	0.0	0.0	0.0	0.0
WSW	0.0018	0.0037	0.0	0.0	0.0	0.0
W	0.0018	0.0065	0.0005	0.0	0.0	0.0
WNW	0.0055	0.0120	0.0037	0.0	0.0	0.0
NW	0.0088	0.0111	0.0037	0.0	0.0	0.0
NNW	0.0032	0.0115	0.0069	0.0	0.0	0.0

Figure 9-18.

```
                 M E T E O R O L O G I C A L   I N P U T   D A T A

                              SUMMER                      WINTER                      ANNUAL

AMBIENT TEMPERATURE :    288.00 DEGREES-KELVIN    288.00 DEGREES-KELVIN    288.00 DEGREES-KELVIN

AMBIENT PRESSURE    :     1000.00 MILLIBARS        1000.00 MILLIBARS        1000.00 MILLIBARS

MIXING DEPTH VALUES :       1000.0 METERS            1000.0 METERS            1000.0 METERS

                SOX :          0.0 HOURS                0.0 HOURS                0.0 HOURS
HALF-LIFE FOR    CO :          0.0 HOURS                0.0 HOURS                0.0 HOURS
               PART :          0.0 HOURS                0.0 HOURS                0.0 HOURS


0.0 HOURS INDICATES HALF LIFE VALUE NOT USED
```

Figure 9-19.

REGION : INSTALLATION TEST CASE

POLLUTANT : SULFUR DIOXIDE

CORRELATION DATA

SO2 MONITORING STATION	RECEPTOR LOCATION		SULFUR DIOXIDE CONCENTRATION (MICROGRAMS/CU. METER)					
			SUMMER		WINTER		ANNUAL	
	HORIZONTAL	VERTICAL	OBSERVED	COMPUTED	OBSERVED	COMPUTED	OBSERVED	COMPUTED
1	40.0	40.0	0.0	0.0	0.0	0.0	21.00	21.12
2	40.0	80.0	0.0	0.0	0.0	0.0	16.00	21.34
3	40.0	130.0	0.0	0.0	0.0	0.0	7.00	9.45
4	80.0	40.0	0.0	0.0	0.0	0.0	16.00	36.59
5	80.0	80.0	0.0	0.0	0.0	0.0	28.00	36.83
6	80.0	130.0	0.0	0.0	0.0	0.0	7.00	9.10
7	130.0	40.0	0.0	0.0	0.0	0.0	15.00	13.89
8	130.0	80.0	0.0	0.0	0.0	0.0	10.00	7.95
9	130.0	130.0	0.0	0.0	0.0	0.0	3.00	4.39

REGION : INSTALLATION TEST CASE

POLLUTANT : PARTICULATES

CORRELATION DATA

PARTICULATE MONITORING STATION	RECEPTOR LOCATION		PARTICULATE CONCENTRATION (MICROGRAMS/CU. METER)					
			SUMMER		WINTER		ANNUAL	
	HORIZONTAL	VERTICAL	OBSERVED	COMPUTED	OBSERVED	COMPUTED	OBSERVED	COMPUTED
1	40.0	40.0	0.0	0.0	0.0	0.0	6.00	4.78
2	40.0	80.0	0.0	0.0	0.0	0.0	7.00	7.13
3	40.0	130.0	0.0	0.0	0.0	0.0	2.00	2.66
4	80.0	40.0	0.0	0.0	0.0	0.0	5.00	8.81
5	80.0	80.0	0.0	0.0	0.0	0.0	11.00	16.89
6	80.0	130.0	0.0	0.0	0.0	0.0	3.00	2.95
7	130.0	40.0	0.0	0.0	0.0	0.0	5.00	5.08
8	130.0	80.0	0.0	0.0	0.0	0.0	5.00	4.65
9	130.0	130.0	0.0	0.0	0.0	0.0	1.00	1.32

Figure 9-20.

```
R E G R E S S I O N   O U T P U T

REGION : INSTALLATION TEST CASE

                                                                REGRESSION COEFFICIENTS
              POLLUTANT         Y-INTERCEPT     SLOPE          COMPUTED   5% CONF. LEVEL

              SULFUR DIOXIDE      0.0            0.0            0.0         0.0           VALUES NOT COMPUTED
S U M M E R   CARBON MONOXIDE     0.0            0.0            0.0         0.0           VALUES NOT COMPUTED
               PARTICULATES       0.0            0.0            0.0         0.0           VALUES NOT COMPUTED

              SULFUR DIOXIDE      0.0            0.0            0.0         0.0           VALUES NOT COMPUTED
W I N T E R   CARBON MONOXIDE     0.0            0.0            0.0         0.0           VALUES NOT COMPUTED
               PARTICULATES       0.0            0.0            0.0         0.0           VALUES NOT COMPUTED

              SULFUR DIOXIDE      2.99732        0.54236        0.83945     0.66600       GOOD CORRELATION
A N N U A L   CARBON MONOXIDE     0.0            0.0            0.0         0.0           VALUES NOT COMPUTED
               PARTICULATES       0.36224        0.61238        0.91834     0.66600       GOOD CORRELATION

IF 'POOR CORRELATION'.....THE COMPUTED SLOPE AND Y-INTERCEPT ARE NOT USED FOR CALIBRATION
```

Figure 9-21.

REGION : INSTALLATION TEST CASE

SEASON : ANNUAL

RECEPTOR CONCENTRATION DATA					
RECEPTOR NUMBER	RECEPTOR LOCATION		EXPECTED ARITHMETIC MEAN		
	(KILOMETERS)		(MICROGRAMS/CU. METER)		
	HORIZ	VERT	SO2	CO	PARTICULATES
1	0.0	0.0	7.44	0.0	2.20
2	0.0	15.0	8.80	0.0	2.48
3	0.0	30.0	10.19	0.0	2.91
4	0.0	45.0	11.08	0.0	3.35
5	0.0	60.0	11.64	0.0	3.75
6	0.0	75.0	11.80	0.0	4.12
7	0.0	90.0	11.31	0.0	4.22
8	0.0	105.0	10.56	0.0	3.91
9	0.0	120.0	9.35	0.0	3.40
10	0.0	135.0	8.43	0.0	3.00
11	0.0	150.0	7.68	0.0	2.62
12	15.0	0.0	7.77	0.0	2.25
13	15.0	15.0	9.65	0.0	2.57
14	15.0	30.0	11.38	0.0	3.06
15	15.0	45.0	12.36	0.0	3.67
16	15.0	60.0	12.95	0.0	4.12
17	15.0	75.0	12.94	0.0	4.50
18	15.0	90.0	12.31	0.0	4.68
19	15.0	105.0	10.90	0.0	4.18
20	15.0	120.0	9.56	0.0	3.56
21	15.0	135.0	8.51	0.0	2.99
22	15.0	150.0	7.60	0.0	2.53
23	30.0	0.0	8.22	0.0	2.31
24	30.0	15.0	10.65	0.0	2.65
25	30.0	30.0	13.26	0.0	3.37
26	30.0	45.0	14.18	0.0	4.12
27	30.0	60.0	14.73	0.0	4.62
28	30.0	75.0	14.66	0.0	5.00
29	30.0	90.0	13.47	0.0	5.39
30	30.0	105.0	11.18	0.0	4.51
31	30.0	120.0	9.85	0.0	3.63
32	30.0	135.0	8.58	0.0	2.88
33	30.0	150.0	7.66	0.0	2.49
34	45.0	0.0	8.80	0.0	2.43
35	45.0	15.0	11.90	0.0	2.87
36	45.0	30.0	16.82	0.0	3.97
37	45.0	45.0	16.28	0.0	4.75
38	45.0	60.0	17.00	0.0	5.14
39	45.0	75.0	16.94	0.0	5.77
40	45.0	90.0	16.19	0.0	6.35

REGION : INSTALLATION TEST CASE

SEASON : ANNUAL

RECEPTOR CONCENTRATION DATA					
RECEPTOR NUMBER	RECEPTOR LOCATION		EXPECTED ARITHMETIC MEAN		
	(KILOMETERS)		(MICROGRAMS/CU. METER)		
	HORIZ	VERT	SO2	CO	PARTICULATES
41	45.0	105.0	12.07	0.0	4.94
42	45.0	120.0	10.39	0.0	3.60
43	45.0	135.0	8.78	0.0	2.83
44	45.0	150.0	7.77	0.0	2.52
45	60.0	0.0	10.59	0.0	3.08
46	60.0	15.0	14.72	0.0	3.53
47	60.0	30.0	30.09	0.0	6.15
48	60.0	45.0	18.29	0.0	5.26
49	60.0	60.0	20.12	0.0	6.04
50	60.0	75.0	20.30	0.0	7.06
51	60.0	90.0	15.30	0.0	8.02
52	60.0	105.0	14.10	0.0	5.47
53	60.0	120.0	10.72	0.0	3.50
54	60.0	135.0	8.68	0.0	2.83
55	60.0	150.0	7.73	0.0	2.47
56	75.0	0.0	18.05	0.0	5.12
57	75.0	15.0	33.49	0.0	7.03
58	75.0	30.0	21.40	0.0	14.69
59	75.0	45.0	21.22	0.0	6.56
60	75.0	60.0	37.62	0.0	8.95
61	75.0	75.0	27.25	0.0	9.59
62	75.0	90.0	18.28	0.0	13.87
63	75.0	105.0	12.33	0.0	5.25
64	75.0	120.0	10.46	0.0	3.56
65	75.0	135.0	8.72	0.0	2.94
66	75.0	150.0	7.77	0.0	2.59
67	90.0	0.0	16.69	0.0	5.06
68	90.0	15.0	20.39	0.0	6.10
69	90.0	30.0	20.42	0.0	7.35
70	90.0	45.0	24.80	0.0	9.31
71	90.0	60.0	46.17	0.0	18.89
72	90.0	75.0	24.69	0.0	14.23
73	90.0	90.0	14.19	0.0	10.46
74	90.0	105.0	10.73	0.0	5.41
75	90.0	120.0	8.97	0.0	3.85
76	90.0	135.0	8.08	0.0	3.09
77	90.0	150.0	7.47	0.0	2.69
78	105.0	0.0	13.88	0.0	4.32
79	105.0	15.0	14.73	0.0	4.97
80	105.0	30.0	15.23	0.0	5.39

REGION : INSTALLATION TEST CASE

SEASON : ANNUAL

RECEPTOR CONCENTRATION DATA

RECEPTOR NUMBER	RECEPTOR LOCATION (KILOMETERS) HORIZ	RECEPTOR LOCATION (KILOMETERS) VERT	EXPECTED ARITHMETIC MEAN (MICROGRAMS/CU. METER) SO2	CO	PARTICULATES
81	105.0	45.0	17.04	0.0	6.17
82	105.0	60.0	16.66	0.0	7.06
83	105.0	75.0	11.71	0.0	5.86
84	105.0	90.0	10.14	0.0	4.18
85	105.0	105.0	9.12	0.0	3.30
86	105.0	120.0	8.09	0.0	3.04
87	105.0	135.0	7.50	0.0	2.94
88	105.0	150.0	7.09	0.0	2.68
89	120.0	0.0	11.71	0.0	3.75
90	120.0	15.0	12.16	0.0	4.17
91	120.0	30.0	12.80	0.0	4.63
92	120.0	45.0	13.20	0.0	5.13
93	120.0	60.0	11.76	0.0	5.03
94	120.0	75.0	9.10	0.0	4.08
95	120.0	90.0	8.21	0.0	3.29
96	120.0	105.0	7.45	0.0	2.66
97	120.0	120.0	7.03	0.0	2.43
98	120.0	135.0	6.83	0.0	2.39
99	120.0	150.0	6.63	0.0	2.42
100	135.0	0.0	10.35	0.0	3.51
101	135.0	15.0	10.75	0.0	3.84
102	135.0	30.0	10.89	0.0	4.08
103	135.0	45.0	10.76	0.0	4.25
104	135.0	60.0	9.29	0.0	3.93
105	135.0	75.0	7.95	0.0	3.51
106	135.0	90.0	6.92	0.0	2.57
107	135.0	105.0	6.40	0.0	2.32
108	135.0	120.0	6.19	0.0	2.16
109	135.0	135.0	6.13	0.0	2.08
110	135.0	150.0	6.05	0.0	2.07
111	150.0	0.0	9.50	0.0	3.35
112	150.0	15.0	9.63	0.0	3.51
113	150.0	30.0	9.42	0.0	3.57
114	150.0	45.0	9.10	0.0	3.55
115	150.0	60.0	7.91	0.0	3.16
116	150.0	75.0	7.00	0.0	2.79
117	150.0	90.0	6.32	0.0	2.30
118	150.0	105.0	5.81	0.0	2.09
119	150.0	120.0	5.62	0.0	1.98
120	150.0	135.0	5.58	0.0	1.92

REGION : INSTALLATION TEST CASE

SEASON : ANNUAL

RECEPTOR CONCENTRATION DATA

RECEPTOR NUMBER	RECEPTOR LOCATION (KILOMETERS)		EXPECTED ARITHMETIC MEAN (MICROGRAMS/CU. METER)		
	HORIZ	VERT	SO2	CO	PARTICULATES
121	150.0	150.0	5.61	0.0	1.89
122	40.0	40.0	15.45	0.0	4.29
123	40.0	80.0	15.57	0.0	5.73
124	40.0	130.0	9.12	0.0	2.99
125	80.0	40.0	23.84	0.0	6.76
126	80.0	80.0	23.86	0.0	11.21
127	80.0	130.0	8.93	0.0	3.17
128	130.0	40.0	11.53	0.0	4.47
129	130.0	80.0	8.31	0.0	4.21
130	130.0	130.0	6.38	0.0	2.17

Figure 9-22.

POLLUTANT CONCENTRATIONS ABOVE STANDARD

REGION : INSTALLATION TEST CASE

POLLUTANT : SULFUR DIOXIDE　　　UNITS : MICROGRAMS/CU. METER

SEASON : ANNUAL　　　STANDARD : 20.00 MICROGRAMS/CU. METER

RECEPTOR NUMBER	ARITHMETIC MEAN CONCENTRATION (MICROGRAMS/CU. M)	EXCESS ABOVE AIR QUALITY STANDARD (MICROGRAMS/CU. M)	CONTRIBUTION FROM POINT SOURCES (MICROGRAMS/CU. M)	CONTRIBUTION FROM AREA SOURCES (MICROGRAMS/CU. M)	NECESSARY REDUCTION FOR POINT SOURCES (PERCENT)	NECESSARY REDUCTION FOR ALL SOURCES (PERCENT)
71	46.1682	26.1682	36.4131	8.7551	71.8648	56.6802
60	37.6246	17.6246	29.1135	7.5110	60.5374	46.8432
57	33.4900	13.4900	29.5443	2.9456	45.6601	40.2806
47	30.0882	10.0882	26.8553	2.2329	37.5651	33.5288
61	27.2494	7.2494	17.7892	8.4602	40.7516	26.6039
70	24.8036	4.8036	16.6276	7.1760	28.8894	19.3666
72	24.6893	4.6893	17.6011	6.0882	26.6420	18.9932
126	23.8634	3.8634	15.6868	7.1766	24.6282	16.1895
125	23.8446	3.0446	17.5166	5.3280	21.9482	16.1235
58	21.3970	1.3970	16.4745	3.9225	8.4796	6.5288
59	21.2176	1.2176	15.0628	5.1549	8.0836	5.7387
69	20.4212	0.4212	13.9795	5.4418	3.0133	2.0628
68	20.3857	0.3857	15.2494	4.1364	2.5295	1.8921
50	20.3012	0.3012	11.2846	8.0146	2.6687	1.4837
49	20.1179	0.1179	12.6361	6.4818	0.9328	0.5859

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                                POLLUTANT CONCENTRATIONS ABOVE STANDARD

REGION : INSTALLATION TEST CASE

                         POLLUTANT :   PARTICULATES                UNITS : MICROGRAMS/CU. METER

                         SEASON :  ANNUAL                          STANDARD :  10.00 MICROGRAMS/CU. METER

|RECEPTOR |  ARITHMETIC MEAN   | EXCESS ABOVE AIR  | CONTRIBUTION FROM | CONTRIBUTION FROM |NECESSARY REDUCTION|NECESSARY REDUCTION|
| NUMBER  |   CONCENTRATION    | QUALITY STANDARD  |   POINT SOURCES   |   AREA SOURCES    | FOR POINT SOURCES |  FOR ALL SOURCES  |
|_________|(MICROGRAMS/CU. M)|(MICROGRAMS/CU. M)|(MICROGRAMS/CU. M)|(MICROGRAMS/CU. M)|     (PERCENT)     |     (PERCENT)     |

|   71    |     18.8856        |      8.8856       |      15.3055      |      2.5802       |      58.0553      |      47.0497      |
|   58    |     14.6897        |      4.6897       |      12.6164      |      1.0733       |      37.1714      |      31.9251      |
|   72    |     14.0261        |      4.0261       |      11.3489      |      1.6772       |      35.4760      |      28.7045      |
|   62    |     13.8697        |      3.8697       |      11.5204      |      1.3493       |      33.5897      |      27.9002      |
|  126    |     11.2138        |      1.2138       |       8.2429      |      1.9709       |      14.7254      |      10.8241      |
|   73    |     10.4591        |      0.4591       |       8.2351      |      1.2240       |       5.5750      |       4.3896      |
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Figure 9-23.

REGION : INSTALLATION TEST CASE

POLLUTANT : SULFUR DIOXIDE   UNITS : MICROGRAMS/CU. METER

SEASON : ANNUAL   AVERAGING TIME : 1. HOURS

S T A T I S T I C A L   D A T A   F O R   S E L E C T E D   R E C E P T O R S

SELECTED RECEPTOR NUMBER	EXPECTED ARITHMETIC MEAN	EXPECTED GEOMETRIC MEAN	1.0 PERCENT CONCENTRATION	2.0 PERCENT CONCENTRATION	3.0 PERCENT CONCENTRATION	EXPECTED MAXIMUM CONCENTRATION	STANDARD GEOMETRIC DEVIATION
34	8.80	6.75	36.81	30.18	26.60	108.84	2.07
55	7.73	5.63	35.92	28.91	25.19	117.33	2.22
64	10.46	8.02	43.72	35.84	31.59	129.27	2.07
101	10.75	8.20	45.46	37.20	32.75	135.80	2.09
102	10.89	8.39	45.02	36.97	32.63	131.74	2.06
103	10.76	8.13	46.50	37.91	33.30	141.74	2.12
104	9.29	7.23	37.56	30.97	27.40	107.67	2.03
106	6.92	3.95	46.47	34.81	28.98	224.66	2.89
107	6.40	4.52	31.52	25.11	21.73	109.06	2.30
109	6.13	3.60	39.79	30.02	25.11	184.88	2.81
111	9.50	6.85	45.01	36.10	31.39	149.92	2.25
112	9.63	7.02	44.73	36.00	31.37	146.12	2.22

REGION : INSTALLATION TEST CASE

POLLUTANT : SULFUR DIOXIDE
UNITS : MICROGRAMS/CU. METER

SEASON : ANNUAL
AVERAGING TIME : 8. HOURS

STATISTICAL DATA FOR SELECTED RECEPTORS

SELECTED RECEPTOR NUMBER	EXPECTED ARITHMETIC MEAN	EXPECTED GEOMETRIC MEAN	1.0 PERCENT CONCENTRATION	2.0 PERCENT CONCENTRATION	3.0 PERCENT CONCENTRATION	EXPECTED MAXIMUM CONCENTRATION	STANDARD GEOMETRIC DEVIATION
34	8.80	7.17	31.81	26.72	23.92	57.99	1.90
55	7.73	6.06	30.81	25.47	22.57	59.37	2.01
64	10.46	8.52	37.78	31.73	28.41	68.88	1.90
101	10.75	8.73	39.25	32.91	29.43	71.97	1.91
102	10.89	8.90	38.93	32.75	29.35	70.58	1.89
103	10.76	8.67	40.09	33.50	29.90	74.33	1.93
104	9.29	7.66	32.54	27.47	24.66	58.31	1.86
106	6.92	4.49	39.12	30.35	25.84	93.65	2.54
107	6.40	4.90	26.94	22.06	19.44	53.58	2.08
109	6.13	4.06	33.53	26.19	22.38	78.54	2.48
111	9.50	7.38	38.56	31.77	28.10	75.10	2.03
112	9.63	7.54	38.37	31.71	28.10	73.93	2.01

REGION : INSTALLATION TEST CASE

POLLUTANT : SULFUR DIOXIDE   UNITS : MICROGRAMS/CU. METER

SEASON : ANNUAL   AVERAGING TIME : 24. HOURS

S T A T I S T I C A L   D A T A   F O R   S E L E C T E D   R E C E P T O R S

SELECTED RECEPTOR NUMBER	EXPECTED ARITHMETIC MEAN	EXPECTED GEOMETRIC MEAN	1.0 PERCENT CONCENTRATION	2.0 PERCENT CONCENTRATION	3.0 PERCENT CONCENTRATION	EXPECTED MAXIMUM CONCENTRATION	STANDARD GEOMETRIC DEVIATION
34	8.80	7.41	29.08	24.77	22.38	41.69	1.80
55	7.73	6.29	28.03	23.53	21.06	41.54	1.90
64	10.46	8.80	34.54	29.43	26.58	49.52	1.80
101	10.75	9.02	35.87	30.51	27.53	51.60	1.81
102	10.89	9.19	35.61	30.38	27.47	50.88	1.79
103	10.76	8.97	36.59	31.03	27.95	53.00	1.83
104	9.29	7.89	29.80	25.50	23.10	42.28	1.77
106	6.92	4.80	35.07	27.78	23.97	59.21	2.35
107	6.40	5.11	24.44	20.34	18.11	36.92	1.96
109	6.13	4.33	30.10	23.98	20.77	50.15	2.30
111	9.50	7.68	35.05	29.34	26.21	52.28	1.92
112	9.63	7.84	34.90	29.30	26.22	51.73	1.90

REGION : INSTALLATION TEST CASE

POLLUTANT : PARTICULATES

SEASON : ANNUAL

UNITS : MICROGRAMS/CU. METER

AVERAGING TIME : 4. HOURS

STATISTICAL DATA FOR SELECTED RECEPTORS

SELECTED RECEPTOR NUMBER	EXPECTED ARITHMETIC MEAN	EXPECTED GEOMETRIC MEAN	1.0 PERCENT CONCENTRATION	2.0 PERCENT CONCENTRATION	3.0 PERCENT CONCENTRATION	EXPECTED MAXIMUM CONCENTRATION	STANDARD GEOMETRIC DEVIATION
55	2.47	2.06	8.42	7.14	6.43	16.69	1.83
64	3.56	2.96	12.14	10.29	9.26	24.06	1.83
101	3.84	3.20	13.09	11.09	9.99	25.94	1.83
102	4.08	3.44	13.43	11.45	10.34	26.02	1.80
103	4.25	3.51	14.83	12.53	11.26	29.86	1.86
104	3.93	3.33	12.61	10.79	9.78	24.06	1.77
105	3.51	2.89	12.22	10.33	9.28	24.60	1.86
106	2.57	1.87	11.95	9.62	8.38	29.41	2.22
107	2.32	1.84	9.01	7.48	6.65	19.51	1.98
109	2.08	1.52	9.57	7.71	6.73	23.40	2.21
111	3.35	2.65	13.00	10.79	9.59	28.15	1.98
112	3.51	2.80	13.36	11.12	9.91	28.51	1.96

REGION : INSTALLATION TEST CASE

POLLUTANT : PARTICULATES

UNITS : MICROGRAMS/CU. METER

SEASON : ANNUAL

AVERAGING TIME : 8. HOURS

STATISTICAL DATA FOR SELECTED RECEPTORS

SELECTED RECEPTOR NUMBER	EXPECTED ARITHMETIC MEAN	EXPECTED GEOMETRIC MEAN	1.0 PERCENT CONCENTRATION	2.0 PERCENT CONCENTRATION	3.0 PERCENT CONCENTRATION	EXPECTED MAXIMUM CONCENTRATION	STANDARD GEOMETRIC DEVIATION
55	2.47	2.09	8.02	6.85	6.20	13.80	1.78
64	3.56	3.01	11.56	9.88	8.94	19.88	1.78
101	3.84	3.25	12.47	10.65	9.64	21.44	1.78
102	4.08	3.49	12.81	11.00	9.98	21.63	1.75
103	4.25	3.57	14.12	12.02	10.85	24.58	1.81
104	3.93	3.38	12.04	10.37	9.44	20.08	1.73
105	3.51	2.94	11.64	9.91	8.94	20.25	1.81
106	2.57	1.92	11.29	9.18	8.05	23.04	2.14
107	2.32	1.88	8.55	7.16	6.40	15.77	1.92
109	2.08	1.56	9.04	7.36	6.46	18.36	2.13
111	3.35	2.71	12.34	10.33	9.23	22.75	1.92
112	3.51	2.86	12.68	10.65	9.54	23.13	1.90

REGION : INSTALLATION TEST CASE

POLLUTANT : PARTICULATES

UNITS : MICROGRAMS/CU. METER

SEASON : ANNUAL

AVERAGING TIME : 24. HOURS

STATISTICAL DATA FOR SELECTED RECEPTORS

SELECTED RECEPTOR NUMBER	EXPECTED ARITHMETIC MEAN	EXPECTED GEOMETRIC MEAN	1.0 PERCENT CONCENTRATION	2.0 PERCENT CONCENTRATION	3.0 PERCENT CONCENTRATION	EXPECTED MAXIMUM CONCENTRATION	STANDARD GEOMETRIC DEVIATION
55	2.47	2.15	7.38	6.38	5.82	10.21	1.70
64	3.56	3.09	10.63	9.20	8.39	14.72	1.70
101	3.84	3.34	11.46	9.92	9.05	15.87	1.70
102	4.08	3.58	11.80	10.26	9.39	16.16	1.67
103	4.25	3.67	12.97	11.19	10.19	18.09	1.72
104	3.93	3.46	11.11	9.69	8.89	15.10	1.65
105	3.51	3.03	10.69	9.22	8.39	14.90	1.72
106	2.57	2.01	10.22	8.45	7.49	15.68	2.01
107	2.32	1.94	7.81	6.63	5.98	11.27	1.82
109	2.08	1.63	8.19	6.78	6.01	12.53	2.00
111	3.35	2.80	11.27	9.57	8.63	16.27	1.82
112	3.51	2.95	11.60	9.88	8.92	16.63	1.80

Figure 9-24.

INSTALLATION TEST CASE

SOURCE CONTRIBUTIONS TO FIVE SELECTED RECEPTORS

ANNUAL   SULFUR DIOXIDE

MICROGRAMS PER CUBIC METER

SOURCE	RECEPTOR 46	RECEPTOR 55	RECEPTOR 109	RECEPTOR 110	RECEPTOR 111
1	1.19 % 0.1752	2.94 % 0.2271	0.99 % 0.0609	1.07 % 0.0646	1.81 % 0.1717
2	1.59 % 0.2346	3.15 % 0.2435	1.23 % 0.0753	1.26 % 0.0759	2.06 % 0.1960
3	1.58 % 0.2325	3.32 % 0.2569	3.43 % 0.2102	3.44 % 0.2077	3.44 % 0.3266
4	2.03 % 0.2993	3.25 % 0.2514	3.12 % 0.1912	3.19 % 0.1931	3.76 % 0.3571
5	2.37 % 0.3493	3.79 % 0.2928	3.63 % 0.2227	3.72 % 0.2249	4.38 % 0.4160
6	0.0 % 0.0	0.0 % 0.0	0.0 % 0.0	0.0 % 0.0	0.0 % 0.0
7	0.0 % 0.0	0.0 % 0.0	0.0 % 0.0	0.0 % 0.0	0.0 % 0.0
8	0.0 % 0.0	0.0 % 0.0	0.0 % 0.0	0.0 % 0.0	0.0 % 0.0
9	0.0 % 0.0	0.0 % 0.0	0.0 % 0.0	0.0 % 0.0	0.0 % 0.0
10	0.0 % 0.0	0.0 % 0.0	0.0 % 0.0	0.0 % 0.0	0.0 % 0.0
11	0.0 % 0.0	0.0 % 0.0	0.0 % 0.0	0.0 % 0.0	0.0 % 0.0
12	0.0 % 0.0	0.0 % 0.0	0.0 % 0.0	0.0 % 0.0	0.0 % 0.0
13	0.0 % 0.0	0.0 % 0.0	0.0 % 0.0	0.0 % 0.0	0.0 % 0.0
14	0.01 % 0.0007	0.02 % 0.0012	0.01 % 0.0006	0.01 % 0.0006	0.01 % 0.0011
15	0.41 % 0.0596	1.21 % 0.0937	1.13 % 0.0692	1.18 % 0.0711	1.13 % 0.1072
16	0.07 % 0.0108	0.23 % 0.0180	0.42 % 0.0258	0.50 % 0.0304	0.41 % 0.0393
17	27.35 % 4.0260	8.04 % 0.6217	5.40 % 0.3311	5.49 % 0.3320	7.93 % 0.7533
18	12.91 % 1.9002	5.75 % 0.4444	10.62 % 0.6514	11.19 % 0.6766	11.14 % 1.0587
19	0.12 % 0.0182	0.45 % 0.0351	0.53 % 0.0327	0.73 % 0.0442	0.70 % 0.0667
20	6.21 % 0.9137	19.78 % 1.5302	6.14 % 0.3766	4.32 % 0.2613	6.15 % 0.5843
21	0.04 % 0.0061	0.33 % 0.0253	0.69 % 0.0424	0.49 % 0.0295	0.29 % 0.0273

INSTALLATION TEST CASE

SOURCE CONTRIBUTIONS TO FIVE SELECTED RECEPTORS

ANNUAL   SULFUR DIOXIDE

MICROGRAMS PER CUBIC METER

SOURCE	RECEPTOR 46	RECEPTOR 55	RECEPTOR 109	RECEPTOR 110	RECEPTOR 111
22	22.84 % 3.3616	10.60 % 0.8196	8.13 % 0.4984	7.95 % 0.4884	7.80 % 0.7410
23	0.01 % 0.0019	0.03 % 0.0026	0.01 % 0.0006	0.01 % 0.0007	0.02 % 0.0019
24	0.07 % 0.0097	0.10 % 0.0076	0.06 % 0.0039	0.05 % 0.0030	0.07 % 0.0062
25	0.13 % 0.0185	0.21 % 0.0159	0.13 % 0.0082	0.14 % 0.0083	0.17 % 0.0161
26	0.02 % 0.0029	0.05 % 0.0038	0.03 % 0.0020	0.04 % 0.0024	0.04 % 0.0036
27	0.18 % 0.0261	0.57 % 0.0439	0.55 % 0.0336	0.63 % 0.0379	0.42 % 0.0400
28	0.35 % 0.0511	1.48 % 0.1141	2.48 % 0.1518	2.21 % 0.1338	1.23 % 0.1169
29	0.01 % 0.0016	0.09 % 0.0067	0.15 % 0.0091	0.15 % 0.0093	0.07 % 0.0063
30	0.06 % 0.0083	0.26 % 0.0199	0.46 % 0.0279	0.43 % 0.0261	0.24 % 0.0229
31	0.31 % 0.0455	0.81 % 0.0627	0.86 % 0.0529	0.94 % 0.0570	1.00 % 0.0948
32	0.45 % 0.0664	1.11 % 0.0856	1.40 % 0.0857	1.35 % 0.0816	1.12 % 0.1069
33	0.03 % 0.0050	0.14 % 0.0107	0.25 % 0.0156	0.28 % 0.0170	0.17 % 0.0165
34	0.0 % 0.0	0.0 % 0.0	0.0 % 0.0	0.0 % 0.0	0.0 % 0.0
35	0.00 % 0.0005	0.00 % 0.0002	0.00 % 0.0001	0.00 % 0.0001	0.00 % 0.0002
36	0.37 % 0.0538	0.32 % 0.0248	0.19 % 0.0116	0.23 % 0.0136	0.30 % 0.0281
37	0.45 % 0.0660	0.45 % 0.0348	0.40 % 0.0246	0.40 % 0.0241	0.44 % 0.0423
38	3.90 % 0.5736	4.48 % 0.3466	5.90 % 0.3618	6.02 % 0.3641	7.31 % 0.6951
39	4.89 % 0.7190	9.10 % 0.7041	14.14 % 0.8666	14.86 % 0.8982	15.94 % 1.5148
40	0.73 % 0.1081	2.38 % 0.1842	5.05 % 0.3097	5.45 % 0.3295	3.85 % 0.3661
41	0.13 % 0.0193	0.30 % 0.0228	0.94 % 0.0578	0.79 % 0.0476	0.55 % 0.0526
42	0.11 % 0.0155	0.19 % 0.0149	0.51 % 0.0310	0.45 % 0.0270	0.46 % 0.0435

INSTALLATION TEST CASE

SOURCE CONTRIBUTIONS TO FIVE SELECTED RECEPTORS

ANNUAL SULFUR DIOXIDE

MICROGRAMS PER CUBIC METER

SOURCE	RECEPTOR 46	RECEPTOR 55	RECEPTOR 109	RECEPTOR 110	RECEPTOR 111
43	0.27 % 0.0390	0.22 % 0.0168	0.32 % 0.0198	0.34 % 0.0208	0.40 % 0.0379
44	0.35 % 0.0521	0.52 % 0.0404	1.04 % 0.0635	1.11 % 0.0674	1.23 % 0.1168
45	0.19 % 0.0276	0.29 % 0.0226	0.73 % 0.0449	0.69 % 0.0414	0.75 % 0.0715
46	0.38 % 0.0566	0.59 % 0.0459	1.77 % 0.1083	1.54 % 0.0932	1.63 % 0.1547
47	0.00 % 0.0004	0.00 % 0.0002	0.00 % 0.0001	0.00 % 0.0001	0.00 % 0.0002
48	0.33 % 0.0480	0.18 % 0.0138	0.17 % 0.0105	0.17 % 0.0102	0.18 % 0.0171
49	0.27 % 0.0402	0.16 % 0.0125	0.17 % 0.0103	0.17 % 0.0103	0.21 % 0.0203
50	0.20 % 0.0288	0.10 % 0.0075	0.21 % 0.0131	0.22 % 0.0134	0.25 % 0.0240
51	0.07 % 0.0103	0.05 % 0.0035	0.11 % 0.0065	0.10 % 0.0058	0.13 % 0.0128
52	0.11 % 0.0159	0.06 % 0.0049	0.18 % 0.0112	0.17 % 0.0101	0.29 % 0.0275
BACK-GROUND	6.79 % 1.	12.93 % 1.	16.31 % 1.	16.54 % 1.	10.52 % 1.
TOTAL	100.0 % 14.7263	100.0 % 7.7349	100.0 % 6.1312	100.0 % 6.0462	100.0 % 9.5034

INSTALLATION TEST CASE

SOURCE CONTRIBUTIONS TO FIVE SELECTED RECEPTORS

ANNUAL PARTICULATES

MICROGRAMS PER CUBIC METER

SOURCE	RECEPTOR 105	RECEPTOR 109	RECEPTOR 110	RECEPTOR 111	RECEPTOR 112
1	0.87 % 0.0305	0.40 % 0.0082	0.41 % 0.0086	0.85 % 0.0284	0.83 % 0.0292
2	2.63 % 0.0921	1.56 % 0.0324	1.54 % 0.0320	3.08 % 0.1030	3.37 % 0.1184
3	0.09 % 0.0033	0.10 % 0.0020	0.09 % 0.0020	0.11 % 0.0038	0.13 % 0.0045
4	0.97 % 0.0339	1.25 % 0.0259	1.24 % 0.0256	1.77 % 0.0591	1.89 % 0.0663
5	0.05 % 0.0018	0.07 % 0.0014	0.07 % 0.0014	0.10 % 0.0032	0.10 % 0.0036
6	3.18 % 0.1115	5.92 % 0.1230	5.77 % 0.1194	10.50 % 0.3513	8.48 % 0.2978
7	3.68 % 0.1292	3.14 % 0.0652	3.08 % 0.0637	3.65 % 0.1222	3.70 % 0.1299
8	0.01 % 0.0005	0.01 % 0.0001	0.01 % 0.0002	0.01 % 0.0004	0.01 % 0.0004
9	0.40 % 0.0142	0.54 % 0.0111	0.66 % 0.0137	1.02 % 0.0340	0.90 % 0.0317
10	0.44 % 0.0154	0.16 % 0.0034	0.20 % 0.0042	0.28 % 0.0095	0.28 % 0.0097
11	26.44 % 0.9267	11.86 % 0.2462	12.19 % 0.2526	17.22 % 0.5762	19.30 % 0.6776
12	0.17 % 0.0060	0.08 % 0.0018	0.09 % 0.0018	0.12 % 0.0039	0.11 % 0.0038
13	0.11 % 0.0039	0.06 % 0.0012	0.06 % 0.0013	0.08 % 0.0028	0.08 % 0.0027
14	0.05 % 0.0018	0.02 % 0.0005	0.02 % 0.0005	0.03 % 0.0011	0.03 % 0.0011
15	0.29 % 0.0101	0.22 % 0.0047	0.23 % 0.0047	0.26 % 0.0088	0.26 % 0.0092
16	0.84 % 0.0295	0.96 % 0.0200	1.11 % 0.0231	1.11 % 0.0373	1.29 % 0.0454
17	0.01 % 0.0003	0.02 % 0.0004	0.02 % 0.0004	0.03 % 0.0010	0.03 % 0.0009
18	0.01 % 0.0002	0.02 % 0.0003	0.02 % 0.0003	0.02 % 0.0006	0.01 % 0.0005
19	0.88 % 0.0310	0.85 % 0.0176	1.13 % 0.0234	1.31 % 0.0439	1.42 % 0.0500
20	0.19 % 0.0066	0.13 % 0.0027	0.09 % 0.0019	0.15 % 0.0052	0.14 % 0.0051
21	10.53 % 0.3693	1.84 % 0.0383	1.26 % 0.0260	0.90 % 0.0301	1.00 % 0.0351

INSTALLATION TEST CASE

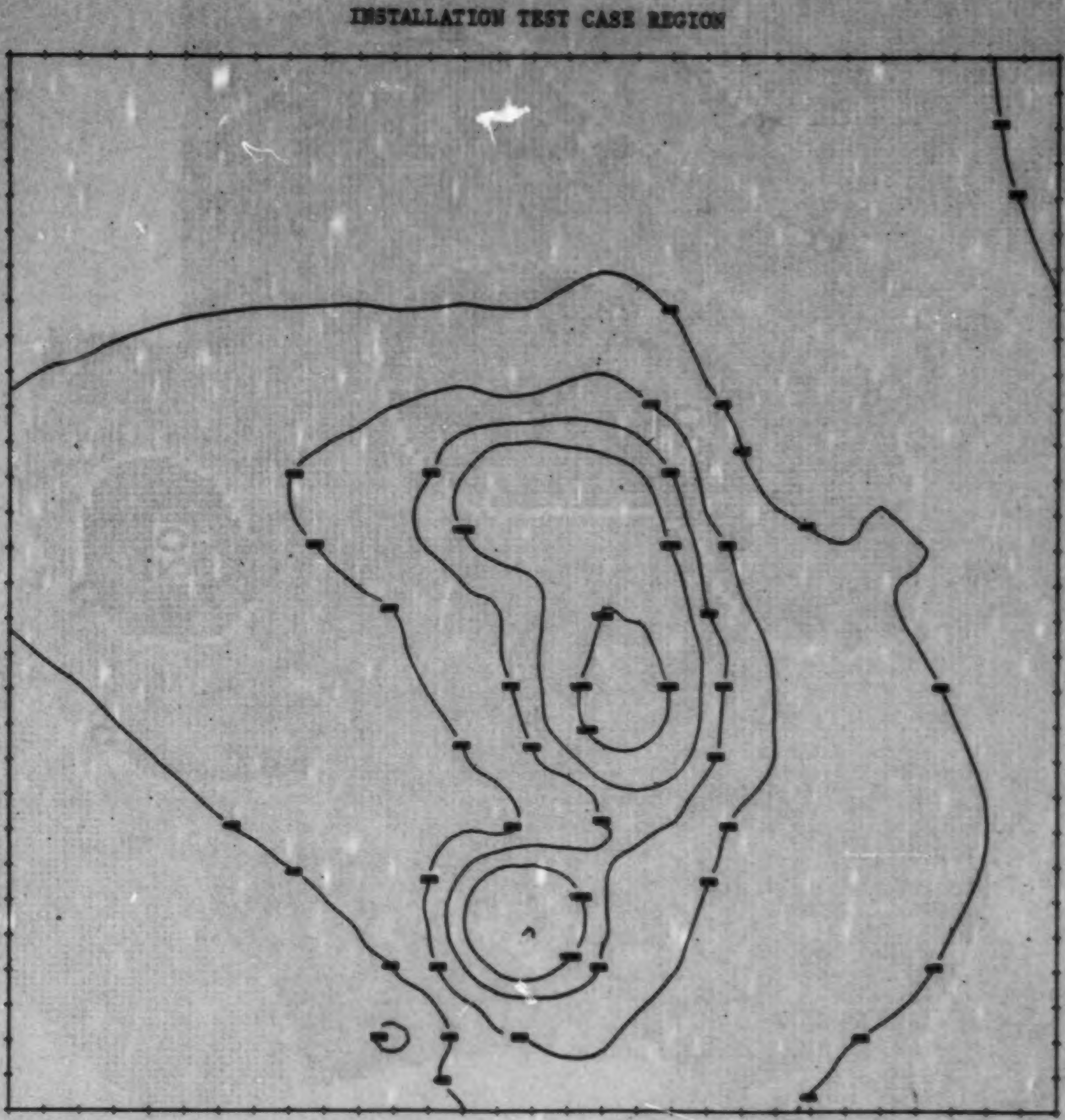
SOURCE CONTRIBUTIONS TO FIVE SELECTED RECEPTORS

ANNUAL PARTICULATES

MICROGRAMS PER CUBIC METER

SOURCE	RECEPTOR 105	RECEPTOR 109	RECEPTOR 110	RECEPTOR 111	RECEPTOR 112
22	0.18 % 0.0065	0.54 % 0.0113	0.51 % 0.0107	0.61 % 0.0205	0.47 % 0.0167
23	0.42 % 0.0146	0.19 % 0.0039	0.20 % 0.0041	0.41 % 0.0137	0.40 % 0.0141
24	0.04 % 0.0012	0.04 % 0.0008	0.03 % 0.0006	0.05 % 0.0016	0.04 % 0.0015
25	0.31 % 0.0108	0.23 % 0.0049	0.23 % 0.0048	0.35 % 0.0116	0.32 % 0.0112
26	0.06 % 0.0023	0.03 % 0.0007	0.04 % 0.0007	0.04 % 0.0013	0.05 % 0.0016
27	0.80 % 0.0280	0.42 % 0.0087	0.47 % 0.0097	0.38 % 0.0128	0.42 % 0.0147
28	1.66 % 0.0582	1.09 % 0.0226	0.94 % 0.0195	0.64 % 0.0213	0.71 % 0.0249
29	0.11 % 0.0039	0.07 % 0.0015	0.07 % 0.0015	0.04 % 0.0013	0.04 % 0.0014
30	0.26 % 0.0090	0.20 % 0.0041	0.18 % 0.0037	0.12 % 0.0041	0.14 % 0.0050
31	0.49 % 0.0171	0.40 % 0.0083	0.42 % 0.0087	0.54 % 0.0181	0.57 % 0.0201
32	0.82 % 0.0289	0.74 % 0.0154	0.69 % 0.0143	0.70 % 0.0234	0.86 % 0.0303
33	0.19 % 0.0066	0.13 % 0.0026	0.14 % 0.0028	0.10 % 0.0034	0.11 % 0.0040
34	0.0 % 0.0	0.0 % 0.0	0.0 % 0.0	0.0 % 0.0	0.0 % 0.0
35	0.00 % 0.0001	0.00 % 0.0001	0.00 % 0.0001	0.01 % 0.0002	0.00 % 0.0002
36	0.15 % 0.0054	0.17 % 0.0035	0.19 % 0.0040	0.31 % 0.0104	0.30 % 0.0105
37	0.15 % 0.0053	0.21 % 0.0043	0.20 % 0.0041	0.27 % 0.0090	0.27 % 0.0096
38	2.43 % 0.0851	2.96 % 0.0615	2.92 % 0.0606	4.31 % 0.1444	3.97 % 0.1395
39	6.75 % 0.2367	8.12 % 0.1686	8.25 % 0.1709	10.75 % 0.3599	10.77 % 0.3782
40	2.14 % 0.0750	2.65 % 0.0551	2.77 % 0.0573	2.37 % 0.0795	3.16 % 0.1110
41	0.26 % 0.0092	0.36 % 0.0074	0.29 % 0.0059	0.24 % 0.0082	0.30 % 0.0104
42	0.15 % 0.0052	0.20 % 0.0042	0.17 % 0.0036	0.22 % 0.0072	0.23 % 0.0082

```
INSTALLATION TEST CASE

SOURCE CONTRIBUTIONS TO FIVE SELECTED RECEPTORS

ANNUAL     PARTICULATES

MICROGRAMS PER CUBIC METER


 ------------------------------------------------------------------------------------
 | SOURCE    |  RECEPTOR   |  RECEPTOR   |  RECEPTOR   |  RECEPTOR   |  RECEPTOR   |
 |           |   105       |   109       |   110       |   111       |   112       |
 ------------------------------------------------------------------------------------
 |    43     |   0.09 %    |   0.15 %    |   0.15 %    |   0.21 %    |   0.21 %    |
 |           |    0.0033   |   0.0030    |   0.0031    |   0.0071    |   0.0074    |
 ------------------------------------------------------------------------------------
 |    44     |   1.10 %    |   1.84 %    |   1.92 %    |   2.57 %    |   2.39 %    |
 |           |    0.0385   |   0.0383    |   0.0398    |   0.0861    |   0.0841    |
 ------------------------------------------------------------------------------------
 |    45     |   0.42 %    |   0.88 %    |   0.80 %    |   1.06 %    |   0.99 %    |
 |           |    0.0147   |   0.0183    |   0.0165    |   0.0356    |   0.0346    |
 ------------------------------------------------------------------------------------
 |    46     |   0.45 %    |   0.65 %    |   0.55 %    |   0.71 %    |   0.96 %    |
 |           |    0.0156   |   0.0135    |   0.0114    |   0.0236    |   0.0336    |
 ------------------------------------------------------------------------------------
 |    47     |   0.00 %    |   0.00 %    |   0.00 %    |   0.00 %    |   0.00 %    |
 |           |    0.0001   |   0.0001    |   0.0001    |   0.0001    |   0.0001    |
 ------------------------------------------------------------------------------------
 |    48     |   0.04 %    |   0.07 %    |   0.07 %    |   0.09 %    |   0.07 %    |
 |           |    0.0015   |   0.0015    |   0.0015    |   0.0031    |   0.0025    |
 ------------------------------------------------------------------------------------
 |    49     |   0.04 %    |   0.08 %    |   0.08 %    |   0.12 %    |   0.08 %    |
 |           |    0.0013   |   0.0016    |   0.0016    |   0.0039    |   0.0029    |
 ------------------------------------------------------------------------------------
 |    50     |   0.04 %    |   0.07 %    |   0.07 %    |   0.10 %    |   0.08 %    |
 |           |    0.0013   |   0.0015    |   0.0016    |   0.0035    |   0.0029    |
 ------------------------------------------------------------------------------------
 |    51     |   0.04 %    |   0.06 %    |   0.05 %    |   0.09 %    |   0.07 %    |
 |           |    0.0013   |   0.0012    |   0.0010    |   0.0029    |   0.0026    |
 ------------------------------------------------------------------------------------
 |    52     |   0.05 %    |   0.06 %    |   0.05 %    |   0.11 %    |   0.12 %    |
 |           |    0.0016   |   0.0013    |   0.0011    |   0.0038    |   0.0041    |
 ------------------------------------------------------------------------------------
 |   BACK-   |  28.53 %    |  48.17 %    |  48.27 %    |  29.98 %    |  28.49 %    |
 |  GROUND   |    1.       |   1.        |   1.        |   1.        |   1.        |
 ------------------------------------------------------------------------------------
 |   TOTAL   |  100.0 %    |  100.0 %    |  100.0 %    |  100.0 %    |  100.0 %    |
 |           |    3.5058   |   2.0762    |   2.0718    |   3.3474    |   3.5110    |
 ------------------------------------------------------------------------------------

IHC219I

TRACEBACK  ROUTINE  CALLED FROM ISN   REG. 14   REG. 15   REG.  0   REG.  1

           IBCOM                      0000CACC  00018CD8  00000001  0000CB68

           MAIN                       00002564  50009880  000000D8  000307F8

ENTRY POINT=  50009880
```


INSTALLATION TEST CASE REGION

Note: Grid marks represent 5 Kilometer spacing.

Figure 9-25. CALCOMP Isopleth of Particulate Matter Ground-Level Concentrations for the Annual Period with No Emission Standards (micrograms per cubic meter x 0.01).

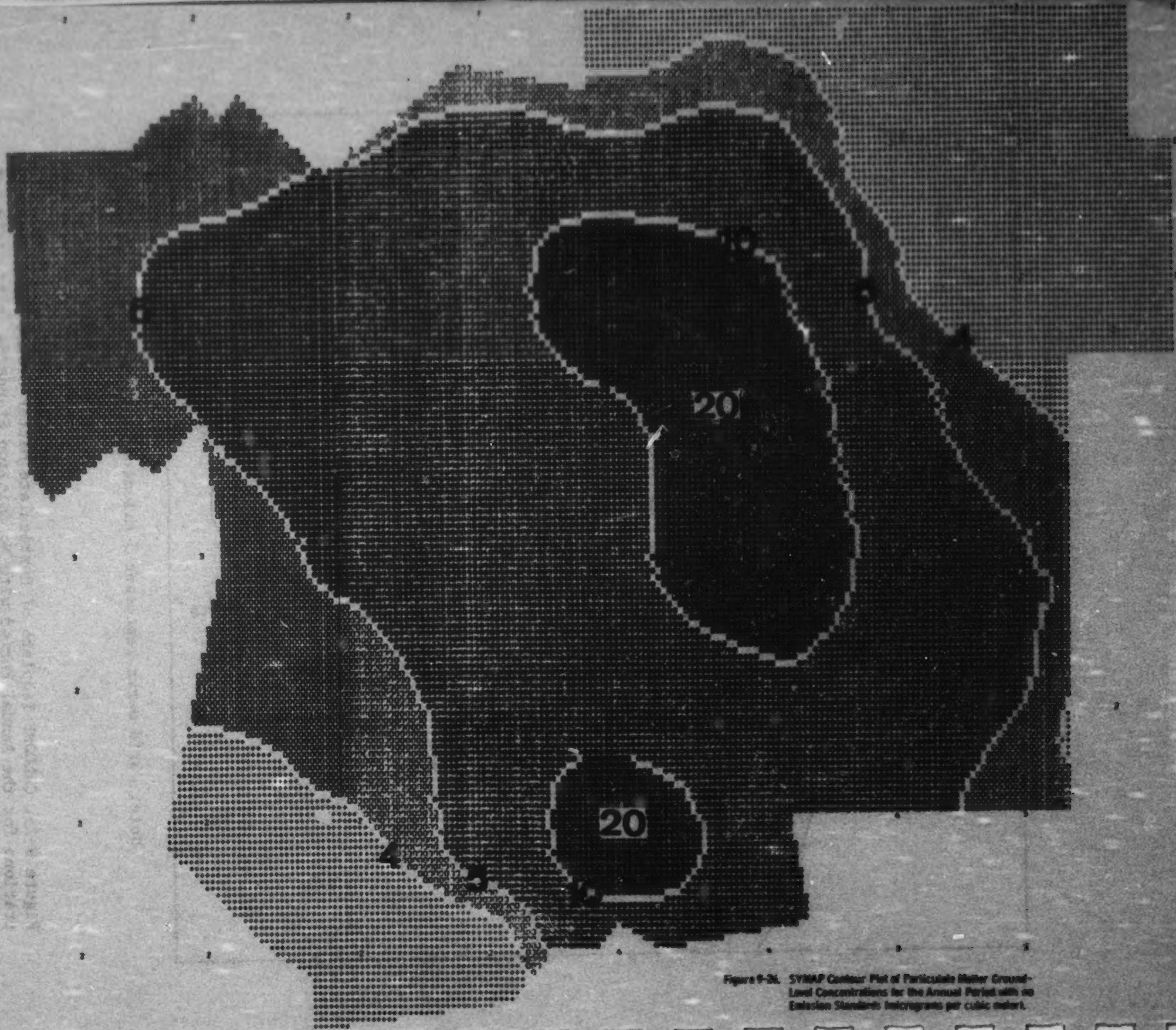


Figure 9-26. SYMAP Contour Plot of Particulate Matter Ground-Level Concentrations for the Annual Period with no Emission Standards (micrograms per cubic meter).

Figure 9-27.

```
                    CONTROL COST-EFFECTIVENESS RUN


                REGION FILE GENERATED  FEBRUARY 27, 1970

                SOURCE FILE GENERATED     MARCH  3, 1970

                DEVICE FILE GENERATED     MARCH  3, 1970


                  CONTROL COST-EFFECTIVENESS DATA                    18 MAR 70

        SOURCE:  CHEMICAL PLANT-BOILER                SIC: 2800   SITE:  410

        OPERATING HOURS: 8760     EXISTING CONTROL:   7     EFFICIENCY:  82.5%

        ACFM(CU.FT./1000):     194     POTENTIAL EMISSIONS
                                     SOX      CO       PART

                                     26.74    0.0      29.2571

                                        EXISTING EMISSIONS
                                     SOX      CO       PART

                                     26.74    0.0      5.1200

      DEVICE               EFFICIENCIES(%)     CONTROLLED EMISSIONS      EFFECTIVENESS ($/TON)
$TOTAL  $CAPITAL  $O&M/1000  SOX   CO   PART     SOX      CO      PART      SOX       CO       PART

7  CYCLONE HI EFFIC
  46       12        34     0.0   0.0  52.0     26.74    0.0     2.4576     0.0       0.0      46.83
```

```
                                        CONTROL COST-EFFECTIVENESS DATA                                 13 MAR 70

                    SOURCE:  CHEMICAL PLANT-BOILER                    SIC: 2800   SITE:  410

                    OPERATING HOURS: 8760      EXISTING CONTROL:   7       EFFICIENCY:  82.5%

                    ACFM(CU.FT./1000):     194            POTENTIAL EMISSIONS
                                                        SOX       CO       PART

                                                        26.74   0.0     29.2571

                                                          EXISTING EMISSIONS
                                                        SOX       CO       PART

                                                        26.74   0.0      5.1200

          DEVICE                          EFFICIENCIES(%)       CONTROLLED EMISSIONS      EFFECTIVENESS ($/TON)
 $TOTAL   $CAPITAL    $O&M/1000   SOX    CO   PART         SOX       CO       PART       SOX        CO       PART

 30  FUEL CHANGE 2% S OIL
   614         0       614      57.0   0.0  91.2         11.49   0.0      0.4525     110.39     0.0     360.62
```

```
                             CONTROL COST-EFFECTIVENESS DATA                         18 MAR 70

                SOURCE:  H2SO4 PLANT-BOILER                        SIC: 2819   SITE:  330

                OPERATING HOURS: 8760      EXISTING CONTROL:   6    EFFICIENCY:  47.5%

                ACFM(CU.FT./1000):     183          POTENTIAL EMISSIONS
                                                 SOX       CO       PART

                                                 31.69    0.0     36.6857

                                                   EXISTING EMISSIONS
                                                 SOX       CO       PART

                                                 31.69    0.0     19.2600

          DEVICE                   EFFICIENCIES(%)       CONTROLLED EMISSIONS        EFFECTIVENESS ($/TON)
  $TOTAL   $CAPITAL   $O&M/1000   SOX    CO   PART       SOX       CO       PART       SOX       CO       PART

   7  CYCLONE HI EFFIC
     50        12         38      0.0   0.0   85.0       31.69    0.0     2.8890       0.0      0.0       8.30

   8  CYCLONE MED EFFIC
     41         9         32      0.0   0.0   75.0       31.69    0.0     4.8150       0.0      0.0       7.82

   9  CYCLONE LO EFFIC
     31         6         25      0.0   0.0   60.0       31.69    0.0     7.7040       0.0      0.0       7.45

  10  ELECT PRECIP HI EFFIC
    100        47         53      0.0   0.0   99.0       31.69    0.0     0.1926       0.0      0.0      14.35

  11  ELECT PRECIP MED EFFIC
     84        34         50      0.0   0.0   95.0       31.69    0.0     0.9630       0.0      0.0      12.58

  12  ELECT PRECIP LO EFFIC
     72        24         48      0.0   0.0   90.0       31.69    0.0     1.9260       0.0      0.0      11.31

  16  FABRIC FILTER HI TEMP
    108        47         61      0.0   0.0   99.0       31.69    0.0     0.1926       0.0      0.0      15.51

  27  FUEL CHANGE 2% S COAL
    199         0        199     45.5   0.0   46.5       17.27    0.0    10.3127      37.84      0.0      60.99
```

```
                          CONTROL COST-EFFECTIVENESS DATA                              18 MAR 70

              SOURCE:  H2SO4 PLANT-BOILER                          SIC: 2819   SITE:  330

              OPERATING HOURS: 3760      EXISTING CONTROL:   6      EFFICIENCY:  47.5%

              ACFM(CU.FT./1000):      183          POTENTIAL EMISSIONS
                                                  SOX       CO       PART

                                                  31.69    0.0      36.6857

                                                     EXISTING EMISSIONS
                                                  SOX       CO       PART

                                                  31.69    0.0      19.2600

       DEVICE                       EFFICIENCIES(%)       CONTROLLED EMISSIONS        EFFECTIVENESS ($/TON)
$TOTAL   $CAPITAL   $O&M/1000   SOX    CO    PART        SOX      CO       PART       SOX      CO       PART

28  FUEL CHANGE 1% S COAL
  357       0         357       72.8   0.0   46.5        8.63     0.0     10.3127     42.39    0.0     109.24

29  FUEL CHANGE 0.5% S COAL
  534       0         534       87.3   0.0   50.1        4.02     0.0      9.6014     52.89    0.0     151.52

30  FUEL CHANGE 2% S OIL
  664       0         664       60.8   0.0   96.6       12.41     0.0      0.6633     94.36    0.0      97.82

31  FUEL CHANGE 1% S OIL
  729       0         729       80.4   0.0   96.6        6.21     0.0      0.6633     78.38    0.0     107.41

32  FUEL CHANGE 0.5% S OIL
  859       0         859       90.2   0.0   96.6        3.10     0.0      0.6633     82.36    0.0     126.60

33  FUEL CHANGE GAS
 1258       0        1258      100.0   0.0   99.5        0.0      0.0      0.1057    108.76    0.0     179.94
```

```
                              CONTROL COST-EFFECTIVENESS DATA                              18 MAR 70

          SOURCE:  H2SO4 PLANT                                   SIC: 2819   SITE:  331

          OPERATING HOURS: 8760     EXISTING CONTROL:  18      EFFICIENCY:  93.7%

          ACFM(CU.FT./1000):      86          POTENTIAL EMISSIONS
                                           SOX       CO        PART

                                           19.10     0.0       4.1270
                                               EXISTING EMISSIONS
                                           SOX       CO        PART

                                           19.10     0.0       0.2600

         DEVICE                    EFFICIENCIES(%)         CONTROLLED EMISSIONS        EFFECTIVENESS ($/TON)
$TOTAL   $CAPITAL   $O&M/1000    SOX    CO    PART         SOX     CO       PART       SOX       CO      PART

13  GAS SCRUBBER
  105       19         86        80.0   0.0   20.0         3.82    0.0      0.2080     18.89     0.0    5550.56
14  MIST ELIMINATOR HI VEL
  82        46         35        0.0    0.0   99.0         19.10   0.0      0.0026     0.0       0.0     874.34
15  MIST ELIMINATOR LO VEL
  55        31         24        0.0    0.0   85.0         19.10   0.0      0.0390     0.0       0.0     676.05
```

```
                              CONTROL COST-EFFECTIVENESS DATA                                        10 MAR 70

              SOURCE:  H2SO4 PLANT BOILER                                    SIC: 2819    SITE:  340

              OPERATING HOURS: 8760      EXISTING CONTROL:   7       EFFICIENCY:  81.3%

              ACFM(CU.FT./1000):      86          POTENTIAL EMISSIONS
                                               SOX        CO        PART

                                               20.36     0.0       20.8556

                                                 EXISTING EMISSIONS
                                               SOX        CO        PART

                                               20.36     0.0        3.9000

          DEVICE                   EFFICIENCIES(%)        CONTROLLED EMISSIONS          EFFECTIVENESS ($/TON)
   $TOTAL  $CAPITAL   $O&M/1000    SOX    CO    PART       SOX       CO        PART        SOX        CO        PART
    7  CYCLONE HI EFFIC
     28          6        22       0.0    0.0   52.0      20.36     0.0      1.8720       0.0        0.0       37.44
   10  ELECT PRECIP HI EFFIC
     70         29        41       0.0    0.0   98.4      20.36     0.0      0.0624       0.0        0.0       50.00
   11  ELECT PRECIP MED EFFIC
     61         21        40       0.0    0.0   92.0      20.36     0.0      0.3120       0.0        0.0       46.43
   12  ELECT PRECIP LO EFFIC
     53         14        39       0.0    0.0   84.0      20.36     0.0      0.6240       0.0        0.0       44.41
   16  FABRIC FILTER HI TEMP
     64         22        42       0.0    0.0   99.0      20.36     0.0      0.0390       0.0        0.0       45.63
   27  FUEL CHANGE 2% S COAL
    122          0       122      38.5    0.0   31.7      12.53     0.0      2.6651      42.56       0.0      269.89
   28  FUEL CHANGE 1% S COAL
    236          0       236      69.2    0.0   31.7       6.26     0.0      2.6651      45.87       0.0      523.54
   29  FUEL CHANGE 0.5% S COAL
    365          0       365      85.7    0.0   36.4       2.92     0.0      2.4813      57.28       0.0      704.29
```

```
                         CONTROL COST-EFFECTIVENESS DATA                            18 MAR 70

               SOURCE:  H2SO4 PLANT BOILER                      SIC: 2819   SITE:  340

               OPERATING HOURS: 8760       EXISTING CONTROL:   7       EFFICIENCY:  81.3%

               ACFM(CU.FT./1000):       86           POTENTIAL EMISSIONS
                                                   SOX        CO        PART

                                                   20.36      0.0       20.8556

                                                     EXISTING EMISSIONS
                                                   SOX        CO        PART

                                                   20.36      0.0       3.9000

          DEVICE                     EFFICIENCIES(%)         CONTROLLED EMISSIONS       EFFECTIVENESS ($/TON)
 $TOTAL   $CAPITAL    $O&M/1000    SOX     CO    PART       SOX        CO        PART       SOX        CO       PART

 30  FUEL CHANGE 2% S OIL
   459       0          459       55.8    0.0   90.9        9.01      0.0       0.3546    110.78      0.0      354.77

 31  FUEL CHANGE 1% S OIL
   506       0          506       77.9    0.0   90.9        4.50      0.0       0.3546     87.49      0.0      391.29

 32  FUEL CHANGE 0.5% S OIL
   601       0          601       88.9    0.0   90.9        2.25      0.0       0.3546     90.91      0.0      464.32

 33  FUEL CHANGE GAS
   890       0          890      100.0    0.0   98.6        0.0       0.0       0.0565    119.77      0.0      634.48
```

```
                         CONTROL COST-EFFECTIVENESS DATA                                  18 MAR 70

            SOURCE:  H2SO4 PLANT                                 SIC: 2819   SITE:  341

            OPERATING HOURS: 3760      EXISTING CONTROL:   0        EFFICIENCY:   0.0%

            ACFM(CU.FT./1000):      86     POTENTIAL EMISSIONS
                                           SOX      CO       PART

                                           23.70    0.0      0.2100

                                            EXISTING EMISSIONS
                                           SOX      CO       PART

                                           23.70    0.0      0.2100

       DEVICE                     EFFICIENCIES(%)      CONTROLLED EMISSIONS      EFFECTIVENESS ($/TON)
$TOTAL  $CAPITAL   $O&M/1000   SOX    CO    PART       SOX      CO      PART      SOX        CO       PART

13  GAS SCRUBBER
  119       19       100       80.0   0.0   80.0       4.74     0.0     0.0420    17.[illegible]  [illegible].0    1938.31

14  MIST ELIMINATOR HI VEL
  82        46       35        0.0    0.0   99.0       23.70    0.0     0.0021    0.0     [illegible].0    1082.52

15  MIST ELIMINATOR LO VEL
  55        31       24        0.0    0.0   85.0       23.70    0.0     0.0315    0.0        0.0      837.01
```

```
                              CONTROL COST-EFFECTIVENESS DATA                                    18 MAR 70

              SOURCE:  HNO3 PLANT                                          SIC: 2819   SITE: 1602

              OPERATING HOURS: 8760       EXISTING CONTROL:   0      EFFICIENCY:   0.0%

              ACFM(CU.FT./1000):      110          POTENTIAL EMISSIONS
                                                  SOX        CO       PART

                                                  0.0        0.0      21.9000
                                                    EXISTING EMISSIONS
                                                  SOX        CO       PART

                                                  0.0        0.0      21.9000

          DEVICE                         EFFICIENCIES(%)       CONTROLLED EMISSIONS        EFFECTIVENESS ($/TON)
$TOTAL   $CAPITAL   $O&M/1000          SOX    CO    PART       SOX       CO       PART      SOX      CO      PART

  1  WET SCRUBBER HI EFFIC
   92        22         70             0.0    0.0   98.0       0.0       0.0     0.4380      0.0      0.0     11.75
  2  WET SCRUBBER MED EFFIC
   56        22         34             0.0    0.0   90.0       0.0       0.0     2.1900      0.0      0.0      7.83
  3  WET SCRUBBER LO EFFIC
   45        13         32             0.0    0.0   80.0       0.0       0.0     4.3800      0.0      0.0      7.09
 14  MIST ELIMINATOR HI VEL
   99        58         41             0.0    0.0   99.0       0.0       0.0     0.2190      0.0      0.0     12.52
```

```
                              CONTROL COST-EFFECTIVENESS DATA                              18 MAR 70

              SOURCE:  FERTILIZER PLANT                                  SIC: 2871   SITE: 2601

              OPERATING HOURS: 8760       EXISTING CONTROL:   7       EFFICIENCY:  80.0%

              ACFM(CU.FT./1000):      107          POTENTIAL EMISSIONS
                                               SOX         CO        PART

                                               0.0      0.0      40.0000

                                                    EXISTING EMISSIONS
                                               SOX         CO        PART

                                               0.0      0.0       8.0000

         DEVICE                   EFFICIENCIES(%)        CONTROLLED EMISSIONS       EFFECTIVENESS ($/TON)
$TOTAL  $CAPITAL   $O&M/1000   SOX    CO   PART        SOX        CO        PART      SOX        CO       PART

10   ELECT PRECIP HI EFFIC
   77        33        44       C.0   0.0  98.7        0.0      0.0      0.1040      0.C       0.0      26.64

18   FABRIC FILTER LO TEMP
   58        11        47       0.0   0.0  99.0        0.0      0.0      0.0800      0.C       0.0      19.97
```

```
                              CONTROL COST-EFFECTIVENESS DATA                          18 MAR 70

                  SOURCE:  OIL PEFINERY                               SIC: 2911   SITE:  611

                  OPERATING HOUFS: 8760        EXISTING CONTROL:    7     EFFICIENCY:  98.0%

                  ACFM(CU.FT./1000):     1360          POTENTIAL EMISSIONS
                                                     SOX        CO      PART

                                                      0.0  521.0000   5.9999
                                                       EXISTING EMISSIONS
                                                     SOX        CO      PART

                                                      0.0  521.0000   0.1200


         DEVICE                  EFFICIENCIES(%)       CONTROLLED EMISSIONS       EFFECTIVENESS ($/TON)
 $TOTAL   $CAPITAL   $O&M/1000   SOX   CO    PART      SOX        CO      PART       SOX       CO       PART

 10  ELECT  PRECIP HI EFFIC
   488      270       218       C.0   0.0   94.6      0.0  521.0000   0.0065      0.C      0.0  11775.68
```

```
                              CONTROL COST-EFFECTIVENESS DATA                          18 MAR 70

               SOURCE:  ASPHALT BATCHING                           SIC: 2951   SITE: 1501

               OPERATING HOURS: 1460       EXISTING CONTROL:   0       EFFICIENCY:   0.0%

               ACFM(CU.FT./1000):       27          POTENTIAL EMISSIONS
                                                 SOX        CO        PART

                                                  0.0      0.0       0.9700

                                                     EXISTING EMISSIONS
                                                 SOX        CO        PART

                                                  0.0      0.0       0.9700

           DEVICE                    EFFICIENCIES(%)        CONTROLLED EMISSIONS       EFFECTIVENESS ($/TON)
  $TOTAL   $CAPITAL   $O&M/1000    SOX    CO    PART       SOX       CO       PART      SOX       CO       PART

    1  WET SCRUBBER HI EFFIC
       8        4        4         0.0    0.0   98.0       0.0      0.0      0.0194     0.0      0.0      24.46

    2  WET SCRUBBER MED EFFIC
       6        4        2         0.0    0.0   90.0       0.0      0.0      0.0970     0.0      0.0      20.07

    3  WET SCRUBBER LO EFFIC
       5        2        3         0.0    0.0   80.0       0.0      0.0      0.1940     0.0      0.0      15.90

    7  CYCLONE HI EFFIC
       4        2        2         0.0    0.0   85.0       0.0      0.0      0.1455     0.0      0.0      13.63

    8  CYCLONE MED EFFIC
       3        2        1         0.0    0.0   75.0       0.0      0.0      0.2425     0.0      0.0      12.56

    9  CYCLONE LO EFFIC
       2        1        1         0.0    0.0   60.0       0.0      0.0      0.3880     0.0      0.0      10.82

   17  FABRIC FILTER MED TEMP
       8        5        3         0.0    0.0   99.0       0.0      0.0      0.0097     0.0      0.0      21.67
```

```
                                  CONTROL COST-EFFECTIVENESS DATA                                  18 MAR 70

               SOURCE:  CEMENT MFG                                       SIC: 3241   SITE: 1001

               OPERATING HOURS: 8760       EXISTING CONTROL:  10        EFFICIENCY:  98.0%

               ACFM(CU.FT./1000):     298          POTENTIAL EMISSIONS
                                                  SOX       CO      PART

                                                  0.0      0.0    139.4985

                                                   EXISTING EMISSIONS
                                                  SOX       CO      PART

                                                  0.0      0.0      2.7900

        DEVICE                     EFFICIENCIES(%)
STOTAL   $CAPITAL    $O&M/1000   SOX    CO    PART      CONTROLLED EMISSIONS          EFFECTIVENESS ($/TON)
                                                        SOX       CO      PART        SOX       CO       PART

10   ELECT PRECIP HI EFFIC
  156       69         87        0.0    0.0   94.6      0.0      0.0     0.1507       0.0      0.0     162.09

16   FABRIC FILTER HI TEMP
  174       76         98        0.0    0.0   99.0      0.0      0.0     0.0279       0.0      0.0     172.57
```

```
                              CONTROL COST-EFFECTIVENESS DATA                              10 MAR 78

                 SOURCE:  ROCK SAND AND GRAVEL                          SIC: 3295   SITE:  511

                 OPERATING HOURS: 2920       EXISTING CONTROL:   0       EFFICIENCY:   0.0%

                 ACFM(CU.FT./1000):      180         POTENTIAL EMISSIONS
                                                    SOX      CO      PART

                                                    0.0     0.0     19.1800

                                                      EXISTING EMISSIONS
                                                    SOX      CO      PART

                                                    0.0     0.0     19.1800

           DEVICE                    EFFICIENCIES(%)        CONTROLLED EMISSIONS        EFFECTIVENESS ($/TON)
    $TOTAL   $CAPITAL   $O&M/1000    SOX    CO    PART      SOX      CO        PART        SOX      CO       PART

     1  WET SCRUBBER HI EFFIC
      72        21         51        0.0   0.0   96.0      0.0     0.0      0.7672       0.0      0.0      10.74

     2  WET SCRUBBER MED EFFIC
      42        21         21        0.0   0.0   90.0      0.0     0.0      1.9180       0.0      0.0       6.74

     3  WET SCRUBBER LO EFFIC
      32        13         19        0.0   0.0   80.0      0.0     C.0      3.8360       0.0      0.0       5.75

     7  CYCLONE HI EFFIC
      29        12         17        C.0   0.0   85.0      0.0     0.0      2.8770       0.0      0.0       4.79

     8  CYCLONE MED EFFIC
      24         9         15        C.0   0.0   75.0      0.0     0.0      4.7950       0.0      0.0       4.49

     9  CYCLONE LO EFFIC
      17         6         11        C.0   0.0   60.0      0.0     0.0      7.6720       0.0      0.0       4.07

    18  FABRIC FILTER LO TEMP
      44        19         25        C.0   0.0   99.0      0.0     0.0      0.1918       0.0      0.0       6.38
```

```
                                                                                    18 MAR 70
                                  CONTROL COST-EFFECTIVENESS DATA

                 SOURCE:  STEEL MILL-BLAST FURNACE                 SIC: 3312   SITE: 1111

                 OPERATING HOURS: 8760     EXISTING CONTROL:   1        EFFICIENCY:  99.7%

                 ACFM(CU.FT./1000):      600          POTENTIAL EMISSIONS
                                                   SOX        CO         PART

                                                   0.0      0.0      333.3044

                                                      EXISTING EMISSIONS
                                                   SOX        CO         PART

                                                   0.0      0.0        1.0000

                                                   CONTROLLED EMISSIONS        EFFECTIVENESS ($/TON)
          DEVICE                    EFFICIENCIES(%)                               SOX      CO       PART
 $TOTAL   $CAPITAL   $O&M/1000      SOX   CO   PART      SOX      CO         PART

  7  WET SCRUBBER HI EFFIC
   338       64        274          0.0   0.0  85.4      0.0      0.0       0.1460      0.0      0.0    1084.50

 10  ELECT PRECIP HI EFFIC
   231      126        105          0.0   0.0  92.5      0.0      0.0       0.0750      0.0      0.0     683.53
```

```
                              CONTROL COST-EFFECTIVENESS DATA                          18 MAR 70

                SOURCE:  STEEL MILL-BCF                               SIC: 3312   SITE: 1112

                OPERATING HOURS: 8760      EXISTING CONTROL:  10        EFFICIENCY:  99.3%

                ACFM(CU.FT./1000):      835           POTENTIAL EMISSIONS
                                                    SOX        CO       PART

                                                    0.0    0.0    105.7084

                                                      EXISTING EMISSIONS
                                                    SOX        CO       PART

                                                    0.0    0.0       0.7400

         DEVICE                      EFFICIENCIES(%)        CONTROLLED EMISSIONS        EFFECTIVENESS ($/TON)
$TOTAL  $CAPITAL    $O&M/1000   SOX    CO   PART          SOX        CO        PART       SOX        CO        PART

 1  WET  SCRUBBER HI EFFIC
  426       88        338       0.0    0.0  85.4          0.0    C.0       0.1080      0.C       0.0   1047.85

10  ELECT PRECIP HI EFFIC
  289      171        119       0.0    0.C  92.5          0.C    0.0       0.0555      0.0       0.0   1157.71
```

```
                         CONTROL COST-EFFECTIVENESS DATA                        18 MAR 70

          SOURCE:  STEEL MILL-SINTERER                     SIC: 3312   SITE: 1113

          OPERATING HOURS: 8760      EXISTING CONTROL:   7      EFFICIENCY:  82.9%

          ACFM(CU.FT./1000):      388         POTENTIAL EMISSIONS
                                            SOX       CO       PART

                                            0.23    0.0       1.5789

                                              EXISTING EMISSIONS
                                            SOX       CO       PART

                                            0.23    0.0       0.2700

        DEVICE                     EFFICIENCIES(%)       CONTROLLED EMISSIONS        EFFECTIVENESS ($/TON)
 $TOTAL   $CAPITAL   $O&M/1000   SOX    CO   PART      SOX      CO       PART        SOX        CO       PART

  7  CYCLONE HI EFFIC
   88        24         64       0.0    0.0  52.0      0.23    0.0      0.1296       0.0        0.0   1724.75

 10  ELECT PRECIP HI EFFIC
  178        86         92       0.0    0.0  95.4      0.23    0.0      0.0124       0.0        0.0   1890.15
```

```
                              CONTROL COST-EFFECTIVENESS DATA                                   18 MAR 79

                 SOURCE:  STEEL FOUNDRY-BOILER                        SIC: 3323   SITE:  710

                 OPERATING HOURS: 8760      EXISTING CONTROL:   0      EFFICIENCY:   0.0%

                 ACFM(CU.FT./1000):     119          POTENTIAL EMISSIONS
                                                   SOX      CO      PART

                                                   6.19   0.0      0.5900

                                                     EXISTING EMISSIONS
                                                   SOX      CO      PART

                                                   6.19   0.0      0.5900

        DEVICE                      EFFICIENCIES(%)       CONTROLLED EMISSIONS        EFFECTIVENESS ($/TON)
$TOTAL   $CAPITAL   $O&M/1000    SOX    CO    PART         SOX     CO        PART        SOX        CO        PART

10  ELECT PRECIP HI EFFIC
   77        35         42       0.0   0.0   75.0         6.19   0.0      0.1475        0.0        0.0     475.80

16  FABRIC FILTER HI TEMP
   76        31         45       0.0   0.0   75.0         6.19   0.0      0.1475        0.0        0.0     467.54

33  FUEL CHANGE GAS
 2352         0       2352     100.0   0.0   12.8         0.0    0.0      0.5143     1041.02       0.0   85160.50
```

```
                       CONTROL COST-EFFECTIVENESS DATA                                     18 MAR 70

                                                                SIC: 3323   SITE:  721
             SOURCE:  STEEL FOUNDRY

             OPERATING HOURS: 8760       EXISTING CONTROL:   0       EFFICIENCY:   0.0%

             ACFM(CU.FT./1000):        6            POTENTIAL EMISSIONS
                                                SOX       CO        PART

                                                0.92    0.0       1.0100

                                                    EXISTING EMISSIONS
                                                SOX       CO        PART

                                                0.92    0.0       1.0100

       DEVICE                          EFFICIENCIES(%)         CONTROLLED EMISSIONS         EFFECTIVENESS ($/TON)
$TOTAL   $CAPITAL    $O&M/1000     SOX    CO    PART        SOX       CO        PART        SOX       CO        PART

  1  WET SCRUBBER HI EFFIC
    17          2         15       0.0    0.0   98.0        0.92    0.0       0.0202        0.0       0.0       46.87

  2  WET SCRUBBER MED EFFIC
    12          2         10       0.0    0.0   90.0        0.92    0.0       0.1010        0.0       0.0       34.98

  3  WET SCRUBBER LO EFFIC
    10          1          9       0.0    0.0   80.0        0.92    0.0       0.2020        0.0       0.0       35.40

  7  CYCLONE HI EFFIC
     8          1          7       0.0    0.0   79.0        0.92    0.0       0.2121        0.0       0.0       27.34

  8  CYCLONE MED EFFIC
     7          1          6       0.0    0.0   69.0        0.92    0.0       0.3131        0.0       0.0       28.90

  9  CYCLONE LO EFFIC
     7          0          7       0.0    0.0   54.0        0.92    0.0       0.4646        0.0       0.0       33.05

 16  FABRIC FILTER HI TEMP
    15          2         13       0.0    0.0   99.0        0.92    0.0       0.0101        0.0       0.0       40.67
```

```
                         CCNTROL COST-EFFECTIVENESS DATA                              18 MAR 70

            SOURCE:  LEAC SMELTER-SINTERER                      SIC: 3332   SITE: 2701

            OPERATING HOURS: 8760       EXISTING CONTROL:  16       EFFICIENCY:  99.0%

            ACFM(CU.FT./1C00):      3C2          POTENTIAL EMISSIONS
                                                SOX       CO       PART
                                              203.00     0.0     30.9993

                                                 EXISTING EMISSIONS
                                                SOX       CO       PART
                                              203.00     0.0      0.3100

      DEVICE                  EFFICIENCIES(%)       CONTROLLED EMISSIONS      EFFECTIVENESS ($/TON)
$TOTAL  $CAPITAL  $O&M/1000   SCX    CO   PART       SOX        CO      PART      SOX      CO        PART

10  ELECT PRECIP HI EFFIC
  156      70        86       C.0   0.0  94.6     203.00     0.0     0.0167     0.0      0.0   1460.10

13  GAS SCRUBBER
  669      36       633       8C.0  0.0  20.0      40.60     0.0     0.2480    11.29     0.0  29502.77

44  H2S04 PLANT-2 CONTACT
-1412     984     -2396       99.5  0.0   0.0       1.02     0.0     0.3100   -19.16     0.0      0.0

45  SULFUR PLANT
 -107    15C5     -1612       95.0  0.0   0.0      10.15     0.0     0.3100    -1.53     0.0      0.0
```

```
                              CONTROL COST-EFFECTIVENESS DATA                                          18 MAR 70

               SOURCE:  LEAD SMELTER-REVERB FURN                          SIC: 3332    SITE: 2703

               OPERATING HOURS: 8760       EXISTING CONTROL:  16         EFFICIENCY:  99.0%

               ACFM(CU.FT./1000):        16              POTENTIAL EMISSIONS
                                                       SOX        CO         PART

                                                       28.20     0.0        2.0000

                                                          EXISTING EMISSIONS
                                                       SOX        CO         PART

                                                       28.20     0.0        0.0200

        DEVICE                        EFFICIENCIES(%)          CONTROLLED EMISSIONS          EFFECTIVENESS ($/TON)
$TOTAL   $CAPITAL   $O&M/1000      SOX    CC    PART           SOX       CO        PART         SOX       CO        PART

10   ELECT PRECIP HI EFFIC
   28          16          12       0.0    0.0   94.6          28.20     0.0       0.0011        0.0       0.0    4083.87

13   GAS SCRUBBER
   95           3          92      80.0    0.0   20.0           5.64     0.0       0.0160       11.58      0.0   65330.28
```

```
                                        CONTROL COST-EFFECTIVENESS DATA                                    18 MAR 70

                          SOURCE:  RAILROAD CAR MFG-BOILER                          SIC: 3742   SITE: 2400

                          OPERATING HOURS: 5840      EXISTING CONTROL:   6      EFFICIENCY:  40.2%

                          ACFM(CU.FT./1000):       16          POTENTIAL EMISSIONS
                                                            SOX        CO         PART

                                                             1.60    0.0        2.0401

                                                              EXISTING EMISSIONS
                                                            SOX        CO         PART

                                                             1.60    0.0        1.2200

               DEVICE                        EFFICIENCIES(%)        CONTROLLED EMISSIONS          EFFECTIVENESS ($/TON)
  $TOTAL   $CAPITAL    $O&M/1000   SOX    CO    PART         SOX       CO        PART        SOX       CO        PART

    7   CYCLONE HI EFFIC
      7          2          5        0.0    0.0   85.0          1.60     0.0        0.1830       0.0       0.0       19.56

    8   CYCLONE MED EFFIC
      7          1          6        0.0    0.0   75.0          1.60     0.0        0.3050       0.0       0.0       19.47

    9   CYCLONE LO EFFIC
      5          1          4        0.0    0.0   60.0          1.60     0.0        0.4880       0.0       0.0       20.14

   10   ELECT PRECIP HI EFFIC
     25         16          9        0.0    0.0   99.0          1.60     0.0        0.0122       0.0       0.0       56.21

   11   ELECT PRECIP MED EFFIC
     20         12          8        0.0    0.0   95.0          1.60     0.0        0.0610       0.0       0.0       48.05

   12   ELECT PRECIP LO EFFIC
     16          8          8        0.0    0.0   90.0          1.60     0.0        0.1220       0.0       0.0       40.07

   16   FABRIC FILTER HI TEMP
     14          5          9        0.0    0.0   99.0          1.60     0.0        0.0122       0.0       0.0       32.83

   27   FUEL CHANGE 2% S COAL
     11          0         11       40.2    0.0   46.6          0.96     0.0        0.6513      47.09       0.0       53.20
```

```
                                CONTROL COST-EFFECTIVENESS DATA                                   18 MAR 70

               SOURCE:  RAILROAD CAR MFG-BOILER                   SIC: 3742   SITE: 2400

               OPERATING HOURS: 5840      EXISTING CONTROL:   6      EFFICIENCY:  40.2%

               ACFM(CU.FT./1000):       16          POTENTIAL EMISSIONS
                                                  SOX        CO       PART

                                                  1.60     0.0      2.0401

                                                     EXISTING EMISSIONS
                                                  SOX        CO       PART

                                                  1.60     0.0      1.2200

        DEVICE                   EFFICIENCIES(%)        CONTROLLED EMISSIONS          EFFECTIVENESS ($/TON)
$TOTAL   $CAPITAL   $O&M/1000   SOX    CO    PART       SOX       CO       PART        SOX       CO       PART

28  FUEL CHANGE 1% S COAL
   20         0         20     70.1   0.0   46.6       0.48     0.0      0.6513      48.33     0.0      95.29

29  FUEL CHANGE 0.5% S COAL
   30         0         30     86.1   0.0   50.3       0.22     0.0      0.6064      58.92     0.0     132.23

30  FUEL CHANGE 2% S OIL
   33         0         33     58.6   0.0   97.1       0.66     0.0      0.0354      96.38     0.0      76.27

31  FUEL CHANGE 1% S OIL
   36         0         36     79.3   0.0   97.1       0.33     0.0      0.0354      78.72     0.0      84.31

32  FUEL CHANGE 0.5% S OIL
   43         0         43     89.6   0.0   97.1       0.17     0.0      0.0354      82.91     0.0     100.39

33  FUEL CHANGE GAS
   54         0         54    100.0   0.0   99.6       0.0      0.0      0.0052      92.09     0.0     121.29
```

```
                              CONTROL COST-EFFECTIVENESS DATA                              18 MAR 70

                  SOURCE:  POWER PLANT   550MW                          SIC: 4911   SITE:   50

                  OPERATING HOURS: 8760      EXISTING CONTROL:  10      EFFICIENCY:  99.2%

                  ACFM(CU.FT./1000):    1128          POTENTIAL EMISSIONS
                                                     SOX       CO       PART

                                                    192.08    0.0    246.2421

                                                       EXISTING EMISSIONS
                                                     SOX       CO       PART

                                                    192.08    0.0      1.9700


        DEVICE                      EFFICIENCIES(%)      CONTROLLED EMISSIONS       EFFECTIVENESS ($/TON)
$TOTAL   $CAPITAL   $O&M/1000    SOX    CO    PART       SOX       CO      PART      SOX      CO       PART

10  ELECT PRECIP HI EFFIC
 431      226        205         0.0   0.0   92.5      192.08    0.0    0.1478      0.0     0.0     647.61

11  ELECT PRECIP MED EFFIC
 352      160        192         0.0   0.0   62.5      192.08    0.0    0.7388      0.0     0.0     784.25

16  FABRIC FILTER HI TEMP
 553      287        266         0.0   0.0   99.0      192.08    0.0    0.0197      0.0     0.0     776.79

27  FUEL CHANGE 2% S COAL
 813       0         813        40.2   0.0   34.7      114.83    0.0    1.2861     28.84    0.0    3257.55

28  FUEL CHANGE 1% S COAL
1232       0        1232        70.1   0.0   34.7       57.41    0.0    1.2861     25.07    0.0    4936.52

29  FUEL CHANGE 0.5% S COAL
2331       0        2331        86.1   0.0   39.2       26.73    0.0    1.1974     38.62    0.0    8264.72

30  FUEL CHANGE 2% S OIL
4907       0        4907        57.0   0.0   67.3       82.54    0.0    0.6448    122.74    0.0   10145.67

31  FUEL CHANGE 1% S OIL
5256       0        5256        78.5   0.0   67.3       41.27    0.0    0.6448     95.48    0.0   10865.81
```

```
                              CONTROL COST-EFFECTIVENESS DATA
                                                                                  18 MAR 70
             SOURCE:  POWER PLANT   550MW
                                                                  SIC: 4911   SITE:   50
             OPERATING HOURS: 8760      EXISTING CONTROL:  10            EFFICIENCY:  99.2%
             ACFM(CU.FT./1000):     1128
                                                  POTENTIAL EMISSIONS
                                                SOX       CO       PART

                                              192.08     0.0     246.2421
                                                  EXISTING EMISSIONS
                                                SOX       CO       PART

                                              192.08     0.0       1.9700
         DEVICE
$TOTAL   $CAPITAL   $O&M/1000   EFFICIENCIES(%)     CONTROLLED EMISSIONS
                                SOX    CO   PART     SOX      CO      PART      EFFECTIVENESS ($/TON)
32  FUEL CHANGE 0.5% S OIL                                                     SOX      CO      PART
 5990        0       5990       89.3   0.0  67.3    20.63    0.0     0.6448    95.72    0.0  12383.93
33  FUEL CHANGE GAS
 7711        0       7711      100.0   0.0  92.2     0.C     0.0     0.1542   109.99    0.0  11635.11
40  ALKALIZED ALUMINA
 3150     1674       1476       80.0   0.0   0.0    38.42    0.0     1.9700    56.17    0.0      0.0
41  DRY LIMESTONE INJECTION
 1653      937        716       50.0   0.0   0.0    96.04    0.0     1.9700    47.17    0.0      0.0
42  WET LIMESTONE INJECTION
 1873     1229        644       80.0   0.0  98.0    38.42    0.0     0.0394    33.39    0.0   2657.88
```

```
                         CONTROL COST-EFFECTIVENESS DATA
                                                                                  18 MAR 70
            SOURCE:  POWER PLANT 55 MW
                                                              SIC: 4911   SITE:   60
            OPERATING HOURS: 8760       EXISTING CONTROL:   0        EFFICIENCY:   0.0%
            ACFM(CU.FT./1000):       21             POTENTIAL EMISSIONS
                                                   SOX      CO        PART

                                                   3.59    0.0       4.5800
                                                     EXISTING EMISSIONS
                                                   SOX        CO       PART

                                                   3.59    0.0       4.5800
         DEVICE
   $TOTAL   $CAPITAL   $OEM/1000   EFFICIENCIES(%)        CONTROLLED EMISSIONS      EFFECTIVENESS ($/TON)
                                   SOX    CO    PART      SOX      CO      PART      SOX        CO        PART
    7  CYCLONE HI EFFIC
     11         2         9        0.0    0.0   85.0      3.59    0.0     0.6870      0.0       0.0        7.99
    8  CYCLONE MED EFFIC
     10         1         9        0.0    0.0   75.0      3.59    0.0     1.1450      0.0       0.0        8.05
    9  CYCLONE LO EFFIC
      9         1         8        0.0    0.0   60.0      3.59    0.0     1.8320      0.0       0.0        8.49
   10  ELECT PRECIP HI EFFIC
     31        17        14        0.0    0.0   99.0      3.59    0.0     0.0458      0.0       0.0       18.80
   11  ELECT PRECIP MED EFFIC
     26        12        14        0.0    0.0   95.0      3.59    0.0     0.2290      0.0       0.0       16.54
   12  ELECT PRECIP LO EFFIC
     22         8        14        0.0    0.0   90.0      3.59    0.0     0.4580      0.0       0.0       14.42
   16  FABRIC FILTER HI TEMP
     22         6        16        0.0    0.0   99.0      3.59    0.0     0.0458      0.0       0.0       13.07
   27  FUEL CHANGE 2% S COAL
     15         0        15       40.2    0.0   34.4      2.15    0.0     3.0053     28.86      0.0       26.45
```

```
                        CCNTROL COST-EFFECTIVENESS DATA                          18 MAR 70

            SOURCE:  POWER PLANT 55 MW                         SIC: 4911   SITE:   60

            OPERATING HOURS: 8760      EXISTING CONTROL:   0      EFFICIENCY:   0.0%

            ACFM(CU.FT./1000):     21           POTENTIAL EMISSIONS
                                               SOX       CO       PART

                                               3.59    0.0       4.5800

                                                 EXISTING EMISSIONS
                                               SOX       CO       PART

                                               3.59    0.0       4.5800

          DEVICE               EFFICIENCIES(%)         CONTROLLED EMISSIONS        EFFECTIVENESS ($/TON)
$TOTAL   $CAPITAL  $O&M/1000   SOX    CO   PART        SOX       CO       PART      SOX       CO       PART

28  FUEL CHANGE 1% S COAL
   23         0        23      70.1   0.0   34.4        1.07    0.0      3.0053     25.08      0.0      40.08

29  FUEL CHANGE 0.5% S COAL
   44         0        44      86.1   0.0   38.9        0.50    0.0      2.7981     38.63      0.0      66.99

30  FUEL CHANGE 2% S OIL
   85         0        85      58.6   0.0   99.0        1.49    0.0      0.0441    110.67      0.0      51.34

31  FUEL CHANGE 1% S OIL
   91         0        91      79.3   0.0   99.0        0.74    0.0      0.0441     87.83      0.0      55.13

32  FUEL CHANGE 0.5% S OIL
  104         0       104      89.7   0.0   99.0        0.37    0.0      0.0441     88.95      0.0      63.11

33  FUEL CHANGE GAS
  116         0       116     100.0   0.0   99.8        0.0     0.0      0.0097     88.47      0.0      69.49
```

```
                              CONTROL COST-EFFECTIVENESS DATA                              18 MAR 70

                SOURCE:  POWER PLANT 923 MW                         SIC: 4911   SITE:    70

                OPERATING HOURS: 8760      EXISTING CONTROL:  10        EFFICIENCY:  97.5%

                ACFM(CU.FT./1000):    2640        POTENTIAL EMISSIONS
                                                 SOX       CO        PART

                                                 377.20    0.0     403.5957

                                                   EXISTING EMISSIONS
                                                 SOX       CO        PART

                                                 377.20    0.0      12.0900

       DEVICE                      EFFICIENCIES(%)        CONTROLLED EMISSIONS       EFFECTIVENESS ($/TON)
$TOTAL  $CAPITAL   $O&M/1000    SOX    CO   PART        SOX       CO        PART      SOX       CO        PART

10  ELECT PRECIP HI EFFIC
  811       512       299       C.0    0.0  94.6      377.20    0.0      0.6529      0.0       0.0     194.27

11  ELECT PRECIP MED EFFIC
  632       363       269       0.0    0.0  73.0      377.20    0.0      3.2643      0.0       0.0     196.15

12  ELECT PRECIP LO EFFIC
  503       261       242       0.0    0.0  46.0      377.20    0.0      6.5286      0.0       0.0     247.92

16  FABRIC FILTER HI TEMP
 1144       672       472       0.0    0.0  99.0      377.20    0.0      0.1209      0.0       0.0     261.91

27  FUEL CHANGE 2% S COAL
 1572         0      1572      37.9    0.0  32.2      234.30    0.0      8.2006     30.14      0.0    1107.44

28  FUEL CHANGE 1% S COAL
 2427         0      2427      68.9    0.0  32.2      117.15    0.0      8.2006     25.57      0.0    1709.85

29  FUEL CHANGE 0.5% S COAL
 4669         0      4669      85.5    0.0  36.8       54.54    0.0      7.6350     39.64      0.0    2871.08

30  FUEL CHANGE 2% S OIL
 9887         0      9887      55.4    0.0  78.2      168.41    0.0      2.6314    129.74      0.0    2863.80
```

```
                                     CONTROL COST-EFFECTIVENESS DATA                                 18 MAR 70

            SOURCE:  POWER PLANT 923 MW                             SIC: 4911   SITE:   70

            OPERATING HOURS: 8760      EXISTING CONTROL:  10       EFFICIENCY:  97.5%

            ACFM(CU.FT./1000):    2640         POTENTIAL EMISSIONS
                                              SOX       CO      PART

                                            377.20    0.0   483.5957

                                                EXISTING EMISSIONS
                                              SOX       CO      PART

                                            377.20    0.0    12.0900

        DEVICE                   EFFICIENCIES(%)        CONTROLLED EMISSIONS      EFFECTIVENESS ($/TON)
$TOTAL   $CAPITAL   $O&M/1000   SOX    CO   PART       SOX      CO      PART     SOX       CO       PART

31  FUEL CHANGE 1% S OIL
10598        0    10598       77.7   0.0   78.2      84.21    0.0     2.6314    99.10     0.0    3069.67

32  FUEL CHANGE 0.5% S OIL
12096        0    12096       88.8   0.0   78.2      42.10    0.0     2.6314    98.90     0.0    3503.68

33  FUEL CHANGE GAS
15608        0    15608      100.0   0.0   94.8       0.0     0.0     0.6292   113.37     0.0    3731.24

40  ALKALIZED ALUMINA
 5813     2915     2898       80.0   0.0    0.0      75.44    0.0    12.0900    52.77     0.0       0.0

41  DRY LIMESTONE INJECTION
 3197     1815     1382       50.0   0.0    0.0     188.60    0.0    12.0900    46.44     0.0       0.0

42  WET LIMESTONE INJECTION
 3410     2272     1138       80.0   0.0   98.0      75.44    0.0     0.2418    30.96     0.0     788.54
```

```
                              CONTROL COST-EFFECTIVENESS DATA
                                                                                  18 MAR 70
          SOURCE:  INCINERATOR
                                                              SIC: 4953   SITE: 1301
          OPERATING HOURS: 8760       EXISTING CONTROL:   0        EFFICIENCY:   0.0%

          ACFM(CU.FT./1000):      212            POTENTIAL EMISSIONS
                                               SOX       CO       PART

                                               0.30    0.1500    2.5500

                                                 EXISTING EMISSIONS
                                               SOX       CO       PART

                                               0.30    0.1500    2.5500

       DEVICE
$TOTAL  $CAPITAL   $O&M/1000  EFFICIENCIES(%)      CONTROLLED EMISSIONS        EFFECTIVENESS ($/TON)
                              SOX    CO   PART     SOX      CO       PART      SOX      CO       PART
 1  WET SCRUBBER HI EFFIC
  124        23        101    0.0   0.0   97.0     0.30   0.1500   0.0765      0.0      0.0     137.31

 2  WET SCRUBBER MED EFFIC
   61        23         39    0.0   0.0   89.0     0.30   0.1500   0.2805      0.0      0.0      73.86

 3  WET SCRUBBER LO EFFIC
   49        15         34    0.0   0.0   79.0     0.30   0.1500   0.5355      0.0      0.0      66.33

10  ELECT PRECIP HI EFFIC
  101        53         48    0.0   0.0   97.0     0.30   0.1500   0.0765      0.0      0.0     112.18
```

```
                         CONTROL COST-EFFECTIVENESS DATA                            18 MAR 70

           SOURCE:  AREA SOURCE                                   SIC: 9999   SITE:   10

           OPERATING HOURS:    0      EXISTING CONTROL:   0       EFFICIENCY:   0.0%

           ACFM(CU.FT./1000):       0        POTENTIAL EMISSIONS
                                          SOX        CO       PART

                                           0.24   0.0       0.0700

                                             EXISTING EMISSIONS
                                          SOX        CO       PART

                                           0.24   0.0       0.0700

          DEVICE             EFFICIENCIES(%)       CONTROLLED EMISSIONS      EFFECTIVENESS ($/TON)
  $TOTAL   $CAPITAL   $O&M/1000   SOX    CO   PART       SOX       CO       PART       SOX       CO        PART
```

Note: In the present version of the program, there are no control measures for area sources (SIC code 9999).

```
DIFFUSION MODEL INPUT DATA CREATED 03/18/70

REGULATION INPUT DATA CREATED  3/19/70

DATE OF SOURCE EMISSION FILE CREATION          MARCH  3, 1970
```

Figure 9-28.

INSTALLATION TEST CASE

REGULATION EFFECTS ON
SOURCE EMISSIONS

FUEL COMBUSTION REGULATION 1 FOR PARTICULATE CONTROL
MISSOURI JURISDICTION

SIC CODE	SITE NUMBER	DEVICE ID	ANNUAL DEVICE COST	DEVICE EFFICIENCY	EMISSIONS (TONS/DAY)		
					EXISTING	ALLOWABLE	CONTROLLED
2819	340	12	$ 53101.00	0.84000	3.90	1.36	0.62
3742	2400	16	$ 14474.60	0.99000	1.22	0.15	0.01
4911	50	0	$ 0.0	0.0	1.97	7.92	1.97

(*) INDICATES MOST EFFICIENT DEVICE WAS USED BUT ALLOWABLE WAS NOT ATTAINED.
(**) INDICATES NO DEVICE AVAILABLE TO CONTROL THE SOURCE

INSTALLATION TEST CASE

REGULATION EFFECTS ON SOURCE EMISSIONS

INDUSTRIAL PROCESS REGULATION 1 FOR PARTICULATE CONTROL
MISSOURI JURISDICTION

SIC CODE	SITE NUMBER	DEVICE ID	ANNUAL DEVICE COST	DEVICE EFFICIENCY	EMISSIONS (TONS/DAY)		
					EXISTING	ALLOWABLE	CONTROLLED
2819	341	0	$ 0.0	0.0	0.21	0.51	0.21
2819	1602	1	$ 92066.38	0.98000	21.90	0.46	0.44
2951	1501	17	$ 7596.68	0.99000	0.97	0.08	0.01
3241	1001	10	$ 156149.00	0.94600	2.79	0.51	0.15
3295	511	18	$ 44237.70	0.99000	19.18	0.24	0.19
3332	2701	0	$ 0.0	0.0	0.31	0.52	0.31
3332	2703	0	$ 0.0	0.0	0.02	0.18	0.02

(*) INDICATES MOST EFFICIENT DEVICE WAS USED BUT ALLOWABLE WAS NOT ATTAINED.
(**) INDICATES NO DEVICE AVAILABLE TO CONTROL THE SOURCE

INSTALLATION TEST CASE

REGULATION EFFECTS ON

SOURCE EMISSIONS

SOLID WASTE DISPOSAL REGULATION 1 FOR PARTICULATE CONTROL
MISSOURI JURISDICTION

SIC CODE	SITE NUMBER	DEVICE ID	ANNUAL DEVICE COST	DEVICE EFFICIENCY	EMISSIONS (TONS/DAY)		
					EXISTING	ALLOWABLE	CONTROLLED
4953	1301	3	$ 48773.90	0.79000	2.55	0.69	0.54

(*) INDICATES MOST EFFICIENT DEVICE WAS USED BUT ALLOWABLE WAS NOT ATTAINED.
(**) INDICATES NO DEVICE AVAILABLE TO CONTROL THE SOURCE

Figure 9-29.

INSTALLATION TEST CASE

03/19/70

JURISDICTION SUMMARY

MISSOURI JURISDICTION

REGULATION TYPE AND NUMBER	TOTAL APPLICABLE POINT SOURCES	TOTAL CONTROLLED POINT SOURCES	EXISTING EMISSIONS FOR POINT SOURCES (TONS/DAY)	EMISSION REDUCTION (TONS/DAY)	ANNUAL CONTROL COST (MILLIONS OF $)	CONTROL COST PER TON REMOVED ($/TON)
FUEL COMBUSTION 1	3	2	7.09	4.48	0.068	41.29
INDUSTRIAL PROCESS 1	7	4	45.38	44.05	0.300	18.66
SOLID WASTE DISPOSAL 1	1	1	2.55	2.01	0.049	66.33
JURISDICTION TOTAL	11	7	55.02	50.55	0.416	22.57

(*) SOME SOURCES COULD NOT ATTAIN THE ALLOWABLE EMISSION
(**) NO DEVICE AVAILABLE TO CONTROL SOME SOURCES.

JURISDICTION EMISSIONS

EXISTING EMISSIONS IN TONS/DAY

POINT SOURCES.... 55.0
AREA SOURCES..... 16.1
TOTAL EMISSIONS.. 71.1
TONS/DAY REMOVED.... 50.5

CONTROLLED EMISSIONS IN TONS/DAY

POINT SOURCES.... 4.5
AREA SOURCES..... 16.1
TOTAL EMISSIONS.. 20.6
PERCENTAGE REDUCTION.......71.1 %

JURISDICTION CONTROL COST-EFFECTIVENESS

REDUCTION IN TOTAL EMISSION RATE . . . . 22.57 DOLLARS/TON

Figure 9-30.

INSTALLATION TEST CASE

03/19/70

REGULATION EFFECTS ON

SOURCE EMISSIONS

FUEL COMBUSTION REGULATION 1 FOR PARTICULATE CONTROL
ILLINOIS JURISDICTION

SIC CODE	SITE NUMBER	DEVICE ID	ANNUAL DEVICE COST	DEVICE EFFICIENCY	EMISSIONS (TONS/DAY)		
					EXISTING	ALLOWABLE	CONTROLLED
2800	410	12	$ 67965.69	0.84000	5.12	1.60	0.82
2819	330	11	$ 84037.00	0.95000	19.26	1.78	0.96
3323	710	0	$ 0.0	0.0	0.59	6.36	0.59
4911	60	16	$ 21638.50	0.99000	4.58	0.22	0.05
4911	70	0	$ 0.0	0.0	12.09	14.81	12.09

(*) INDICATES MOST EFFICIENT DEVICE WAS USED BUT ALLOWABLE WAS NOT ATTAINED.
(**) INDICATES NO DEVICE AVAILABLE TO CONTROL THE SOURCE

INSTALLATION TEST CASE

03/19/70

REGULATION EFFECTS ON

SOURCE EMISSIONS

INDUSTRIAL PROCESS REGULATION 1 FOR PARTICULATE CONTROL
ILLINOIS JURISDICTION

SIC CODE	SITE NUMBER	DEVICE ID	ANNUAL DEVICE COST	DEVICE EFFICIENCY	EMISSIONS (TONS/DAY)		
					EXISTING	ALLOWABLE	CONTROLLED
2819	331	0	$ 0.0	0.0	0.26	0.52	0.26
2871	2601	18	$ 57723.70	0.99000	8.00	0.18	0.08
2911	611	0	$ 0.0	0.0	0.12	0.97	0.12
3312	1111	10	$ 230776.00	0.92500	1.00	0.64	0.08
3312	1112	10	$ 289245.00	0.92500	0.74	0.69	0.06
3312	1113	0	$ 0.0	0.0	0.27	0.55	0.27
3323	721	2	$ 11606.60	0.90000	1.01	0.15	0.10

(*) INDICATES MOST EFFICIENT DEVICE WAS USED BUT ALLOWABLE WAS NOT ATTAINED.
(**) INDICATES NO DEVICE AVAILABLE TO CONTROL THE SOURCE

Figure 9-31.

INSTALLATION TEST CASE 03/19/70

J U R I S D I C T I O N   S U M M A R Y

ILLINOIS JURISDICTION

REGULATION TYPE AND NUMBER	TOTAL APPLICABLE POINT SOURCES	TOTAL CONTROLLED POINT SOURCES	EXISTING EMISSIONS FOR POINT SOURCES (TONS/DAY)	EMISSION REDUCTION (TONS/DAY)	ANNUAL CONTROL COST (MILLIONS OF $)	CONTROL COST PER TON REMOVED ($/TON)
FUEL COMBUSTION 1	5	3	41.64	27.13	0.174	17.53
INDUSTRIAL PROCESS 1	7	4	11.40	10.44	0.589	154.68
SOLID WASTE DISPOSAL 1	0	0	0.0	0.0	0.0	0.0
JURISDICTION TOTAL	12	7	53.04	37.57	0.763	55.64

(*) SOME SOURCES COULD NOT ATTAIN THE ALLOWABLE EMISSION
(**) NO DEVICE AVAILABLE TO CONTROL SOME SOURCES.

J U R I S D I C T I O N   E M I S S I O N S

EXISTING EMISSIONS IN TONS/DAY

POINT SOURCES.... 53.0

AREA SOURCES..... 7.5

TOTAL EMISSIONS.. 60.5

TONS/DAY REMOVED.... 37.6

CONTROLLED EMISSIONS IN TONS/DAY

POINT SOURCES.... 15.5

AREA SOURCES..... 7.5

TOTAL EMISSIONS.. 23.0

PERCENTAGE REDUCTION.......62.0 %

J U R I S D I C T I O N   C O N T R O L   C O S T - E F F E C T I V E N E S S

REDUCTION IN TOTAL EMISSION RATE . . . . 55.64 DOLLARS/TON

Figure 9-32.

```
                                    INSTALLATION TEST CASE                                    03/19/70

                                 CONTROL STRATEGY EFFECTS ON
                                 CONCENTRATIONS AT GROUND LEVEL

AIR QUALITY STANDARD   20.0   MICROGRAMS/CUBIC METER
----------------------------------------------------------------------------------------------------------
| RECEPTOR |        LOCATIONS          | NEW CONCENTRATION VALUE|     AMOUNT REDUCED      |    AMOUNT IN EXCESS     |
|          |     UTM,KILOMETERS        |                        |                         |                         |
| NUMBER   |      X      |      Y      | MICROGRAMS/CUBIC METER | MICROGRAMS/CUBIC METER  | MICROGRAMS/CUBIC METER  |
|    1     |     0.0     |     0.0     |    0.165938E 01        |     0.466023E 00        |     0.0                 |
|    2     |     0.0     |    15.00    |    0.175017E 01        |     0.570616E 00        |     0.0                 |
|    3     |     0.0     |    30.00    |    0.194424E 01        |     0.755847E 00        |     0.0                 |
|    4     |     0.0     |    45.00    |    0.213037E 01        |     0.104959E 01        |     0.0                 |
|    5     |     0.0     |    60.00    |    0.233927E 01        |     0.134829E 01        |     0.0                 |
|    6     |     0.0     |    75.00    |    0.243517E 01        |     0.194251E 01        |     0.0                 |
|    7     |     0.0     |    90.00    |    0.237403E 01        |     0.241261E 01        |     0.0                 |
|    8     |     0.0     |   105.00    |    0.224950E 01        |     0.225263E 01        |     0.0                 |
|    9     |     0.0     |   120.00    |    0.201478E 01        |     0.186964E 01        |     0.0                 |
|   10     |     0.0     |   135.00    |    0.188592E 01        |     0.149098E 01        |     0.0                 |
|   11     |     0.0     |   150.00    |    0.177222E 01        |     0.111517E 01        |     0.0                 |
|   12     |    15.00    |     0.0     |    0.167430E 01        |     0.471277E 00        |     0.0                 |
|   13     |    15.00    |    15.00    |    0.177287E 01        |     0.589100E 00        |     0.0                 |
|   14     |    15.00    |    30.00    |    0.194519E 01        |     0.758068E 00        |     0.0                 |
|   15     |    15.00    |    45.00    |    0.222370E 01        |     0.113210E 01        |     0.0                 |
|   16     |    15.00    |    60.00    |    0.248777E 01        |     0.153842E 01        |     0.0                 |
|   17     |    15.00    |    75.00    |    0.261420E 01        |     0.225209E 01        |     0.0                 |
|   18     |    15.00    |    90.00    |    0.252959E 01        |     0.291727E 01        |     0.0                 |
|   19     |    15.00    |   105.00    |    0.226415E 01        |     0.262764E 01        |     0.0                 |
|   20     |    15.00    |   120.00    |    0.203464E 01        |     0.209123E 01        |     0.0                 |
|   21     |    15.00    |   135.00    |    0.188205E 01        |     0.149135E 01        |     0.0                 |
|   22     |    15.00    |   150.00    |    0.173859E 01        |     0.103372E 01        |     0.0                 |
|   23     |    30.00    |     0.0     |    0.167885E 01        |     0.496895E 00        |     0.0                 |
|   24     |    30.00    |    15.00    |    0.180077E 01        |     0.611592E 00        |     0.0                 |
|   25     |    30.00    |    30.00    |    0.199194E 01        |     0.220028E 01        |     0.0                 |
|   26     |    30.00    |    45.00    |    0.235557E 01        |     0.281309E 01        |     0.0                 |
|   27     |    30.00    |    60.00    |    0.270660E 01        |     0.184625E 01        |     0.0                 |
|   28     |    30.00    |    75.00    |    0.286871E 01        |     0.266820E 01        |     0.0                 |
|   29     |    30.00    |    90.00    |    0.272179E 01        |     0.370003E 01        |     0.0                 |
|   30     |    30.00    |   1C5.00    |    0.228904E 01        |     0.312540E 01        |     0.0                 |
|   31     |    30.00    |   120.00    |    0.205604E 01        |     C.219850E 01        |     0.0                 |
|   32     |    30.00    |   135.00    |    0.184291E 01        |     0.164514E 01        |     0.0                 |
|   33     |    30.00    |   150.00    |    0.172230E 01        |     0.120214E 01        |     0.0                 |
|   34     |    45.00    |     0.0     |    0.173511E 01        |     0.110016E 01        |     0.0                 |
|   35     |    45.00    |    15.00    |    0.185226E 01        |     0.163368E 01        |     0.0                 |
|   36     |    45.00    |    30.00    |    0.205118E 01        |     0.309743E 01        |     0.0                 |
|   37     |    45.00    |    45.00    |    0.242268E 01        |     0.373091E 01        |     0.0                 |
|   38     |    45.00    |    60.00    |    0.302471E 01        |     0.337767E 01        |     0.0                 |
|   39     |    45.00    |    75.00    |    0.323634E 01        |     0.326708E 01        |     0.0                 |
|   40     |    45.00    |    90.00    |    0.287286E 01        |     0.501008E 01        |     0.0                 |
|   41     |    45.00    |   105.00    |    0.235050E 01        |     0.409905E 01        |     0.0                 |
```

INSTALLATION TEST CASE 03/19/70

CONTROL STRATEGY EFFECTS ON
CONCENTRATIONS AT GROUND LEVEL

AIR QUALITY STANDARD 20.0 MICROGRAMS/CUBIC METER

RECEPTOR NUMBER	LOCATIONS UTM,KILOMETERS X	Y	NEW CONCENTRATION VALUE MICROGRAMS/CUBIC METER	AMOUNT REDUCED MICROGRAMS/CUBIC METER	AMOUNT IN EXCESS MICROGRAMS/CUBIC METER
42	45.00	120.00	0.202701E 01	0.249130E 01	0.0
43	45.00	135.00	0.182787E 01	0.157999E 01	0.0
44	45.00	150.00	0.174335E 01	0.121598E 01	0.0
45	60.00	0.0	0.193185E 01	0.185028E 01	0.0
46	60.00	15.00	0.204766E 01	0.238211E 01	0.0
47	60.00	30.00	0.221258E 01	0.637563E 01	0.0
48	60.00	45.00	0.252029E 01	0.446903E 01	0.0
49	60.00	60.00	0.337336E 01	0.435641E 01	0.0
50	60.00	75.00	0.371787E 01	0.545633E 01	0.0
51	60.00	90.00	0.298251E 01	0.822934E 01	0.0
52	60.00	105.00	0.238652E 01	0.503158E 01	0.0
53	60.00	120.00	0.202618E 01	0.232955E 01	0.0
54	60.00	135.00	0.185954E 01	0.156648E 01	0.0
55	60.00	150.00	0.175072E 01	0.117638E 01	0.0
56	75.00	0.0	0.221354E 01	0.464387E 01	0.0
57	75.00	15.00	0.244342E 01	0.737176E 01	0.0
58	75.00	30.00	0.280849E 01	0.193729E 02	0.0
59	75.00	45.00	0.302501E 01	0.578026E 01	0.0
60	75.00	60.00	0.416843E 01	0.780375E 01	0.0
61	75.00	75.00	0.416263E 01	0.886596E 01	0.0
62	75.00	90.00	0.302921E 01	0.177168E 02	0.0
63	75.00	105.00	0.239129E 01	0.466164E 01	0.0
64	75.00	120.00	0.205396E 01	0.246139E 01	0.0
65	75.00	135.00	0.187491E 01	0.174065E 01	0.0
66	75.00	150.00	0.177718E 01	0.133048E 01	0.0
67	90.00	0.0	0.243992E 01	0.413111E 01	0.0
68	90.00	15.00	0.269975E 01	0.535921E 01	0.0
69	90.00	30.00	0.314862E 01	0.672173E 01	0.0
70	90.00	45.00	0.388253E 01	0.886212E 01	0.0
71	90.00	60.00	0.498334E 01	0.227170E 02	0.0
72	90.00	75.00	0.397497E 01	0.164265E 02	0.0
73	90.00	90.00	0.279160E 01	0.125218E 02	0.0
74	90.00	105.00	0.239791E 01	0.492703E 01	0.0
75	90.00	120.00	0.209750E 01	0.286934E 01	0.0
76	90.00	135.00	0.192989E 01	0.190034E 01	0.0
77	90.00	150.00	0.182399E 01	0.140879E 01	0.0
78	105.00	0.0	0.239939E 01	0.301729E 01	0.0
79	105.00	15.00	0.266277E 01	0.362649E 01	0.0
80	105.00	30.00	0.305137E 01	0.372535E 01	0.0
81	105.00	45.00	0.350307E 01	0.435679E 01	0.0
82	105.00	60.00	0.345880E 01	0.588160E 01	0.0

```
                                        INSTALLATION TEST CASE                                        03/19/70

                                      CONTROL STRATEGY EFFECTS ON
                                      CONCENTRATIONS AT GROUND LEVEL

AIR QUALITY STANDARD    20.0    MICROGRAMS/CUBIC METER
------------------------------------------------------------------------------------------------------------------------
I RECEPTOR I          LOCATIONS           I NEW CONCENTRATION VALUEI      AMOUNT REDUCED      I     AMOUNT IN EXCESS      I
I          I      . UTM,KILOMETERS        I                        I                          I                           I
I NUMBER   I        X       I       Y     I MICROGRAMS/CUBIC METER I  MICROGRAMS/CUBIC METER  I  MICROGRAMS/CUBIC METER   I
I    83    I     105.00     I     75.00   I     0.262292E 01       I     0.528192E 01         I       0.0                 I
I    84    I     105.00     I     90.00   I     0.233360E 01       I     0.302035E 01         I       0.0                 I
I    85    I     105.00     I    105.00   I     0.214524E 01       I     0.188082E 01         I       0.0                 I
I    86    I     105.00     I    120.00   I     0.201842E 01       I     0.166692E 01         I       0.0                 I
I    87    I     105.00     I    135.00   I     0.191145E 01       I     0.167284E 01         I       0.0                 I
I    88    I     105.00     I    150.00   I     0.182166E 01       I     0.140796E 01         I       0.0                 I
I    89    I     120.00     I      0.0    I     0.229766E 01       I     0.161112E 01         I       0.0                 I
I    90    I     120.00     I     15.00   I     0.248363E 01       I     0.196605E 01         I       0.0                 I
I    91    I     120.00     I     30.00   I     0.280119E 01       I     0.247832E 01         I       0.0                 I
I    92    I     120.00     I     45.00   I     0.297054E 01       I     0.317414E 01         I       0.0                 I
I    93    I     120.00     I     60.00   I     0.272246E 01       I     0.355411E 01         I       0.0                 I
I    94    I     120.00     I     75.00   I     0.223994E 01       I     0.284437E 01         I       0.0                 I
I    95    I     120.00     I     90.00   I     0.200538E 01       I     0.209090E 01         I       0.0                 I
I    96    I     120.00     I    105.00   I     0.188623E 01       I     0.126663E 01         I       0.0                 I
I    97    I     120.00     I    120.00   I     0.183680E 01       I     0.971797E 00         I       0.0                 I
I    98    I     120.00     I    135.00   I     0.181830E 01       I     0.931515E 00         I       0.0                 I
I    99    I     120.00     I    150.00   I     0.179042E 01       I     0.102588E 01         I       0.0                 I
I   100    I     135.00     I      0.0    I     0.221412E 01       I     0.153964E 01         I       0.0                 I
I   101    I     135.00     I     15.00   I     0.240085E 01       I     0.180235E 01         I       0.0                 I
I   102    I     135.00     I     30.00   I     0.251256E 01       I     0.217036E 01         I       0.0                 I
I   103    I     135.00     I     45.00   I     0.251352E 01       I     0.243725E 01         I       0.0                 I
I   104    I     135.00     I     60.00   I     0.224485E 01       I     0.246528E 01         I       0.0                 I
I   105    I     135.00     I     75.00   I     0.198616E 01       I     0.226949E 01         I       0.0                 I
I   106    I     135.00     I     90.00   I     0.182144E 01       I     0.106108E 01         I       0.0                 I
I   107    I     135.00     I    105.00   I     0.171532E 01       I     0.960789E 00         I       0.0                 I
I   108    I     135.00     I    120.00   I     0.169943E 01       I     0.747570E 00         I       0.0                 I
I   109    I     135.00     I    135.00   I     0.169024E 01       I     0.630142E 00         I       0.0                 I
I   110    I     135.00     I    150.00   I     0.168614E 01       I     0.629707E 00         I       0.0                 I
I   111    I     150.00     I      0.0    I     0.217974E 01       I     0.142610E 01         I       0.0                 I
I   112    I     150.00     I     15.00   I     0.224800E 01       I     0.162917E 01         I       0.0                 I
I   113    I     150.00     I     30.00   I     0.225931E 01       I     0.177236E 01         I       0.0                 I
I   114    I     150.00     I     45.00   I     0.221635E 01       I     0.184994E 01         I       0.0                 I
I   115    I     150.00     I     60.00   I     0.200120E 01       I     0.166456E 01         I       0.0                 I
I   116    I     150.00     I     75.00   I     0.183971E 01       I     0.137711E 01         I       0.0                 I
I   117    I     150.00     I     90.00   I     0.171740E 01       I     0.807814E 00         I       0.0                 I
I   118    I     150.00     I    105.00   I     0.162882E 01       I     0.633570E 00         I       0.0                 I
I   119    I     150.00     I    120.00   I     0.160515E 01       I     0.587306E 00         I       0.0                 I
I   120    I     150.00     I    135.00   I     0.160604E 01       I     0.508934E 00         I       0.0                 I
I   121    I     150.00     I    150.00   I     0.160890E 01       I     0.456117E 00         I       0.0                 I
I   122    I      40.00     I     40.00   I     0.222220E 01       I     0.331434E 01         I       0.0                 I
I   123    I      40.00     I     80.00   I     0.303130E 01       I     0.356742E 01         I       0.0                 I
```

```
                                   INSTALLATION TEST CASE                                        03/19/70

                                CONTROL STRATEGY EFFECTS ON
                                CONCENTRATIONS AT GROUND LEVEL

AIR QUALITY STANDARD   20.0    MICROGRAMS/CUBIC METER
---------------------------------------------------------------------------------------------------------------
| RECEPTOR |          LOCATIONS           | NEW CONCENTRATION VALUE|     AMOUNT REDUCED      |    AMOUNT IN EXCESS    |
|          |       UTM,KILOMETERS         |                        |                         |                        |
| NUMBER   |      X        |       Y      | MICROGRAMS/CUBIC METER | MICROGRAMS/CUBIC METER  | MICROGRAMS/CUBIC METER |
|   124    |     40.00     |    130.00    |    0.186937E 01        |    0.176953E 01         |    0.0                 |
|   125    |     80.00     |     40.00    |    0.317710E 01        |    0.584729E 01         |    0.0                 |
|   126    |     80.00     |     80.00    |    0.380513E 01        |    0.121014E 02         |    0.0                 |
|   127    |     80.00     |    130.00    |    0.194576E 01        |    0.199883E 01         |    0.0                 |
|   128    |    130.00     |     40.00    |    0.263044E 01        |    0.253007E 01         |    0.0                 |
|   129    |    130.00     |     80.00    |    0.196212E 01        |    0.352670E 01         |    0.0                 |
|   130    |    130.00     |    130.00    |    0.172912E 01        |    0.720093E 00         |    0.0                 |
```

Figure 9-33.

INSTALLATION TEST CASE

STATISTICAL DATA FOR SELECTED RECEPTORS

ANNUAL PARTICULATES

MICROGRAMS PER CUBIC METER

AVERAGING TIME 4. HOURS

RECEPTOR	EXPECTED STATISTICAL PARAMETERS						
NUMBER	ARITHMETIC MEAN	GEOMETRIC MEAN	MAXIMUM CONCENTRATION	1.0 % CONCENTRATION	2.0 % CONCENTRATION	3.0 % CONCENTRATION	STANDARD GEOMETRIC DEVIATION
55	2.	1.	12.	6.	5.	5.	1.83
64	2.	2.	14.	7.	6.	5.	1.83
101	2.	2.	16.	8.	7.	6.	1.83
102	3.	2.	16.	8.	7.	6.	1.80
103	3.	2.	18.	9.	7.	7.	1.86
104	2.	2.	14.	7.	6.	6.	1.77
105	2.	2.	14.	7.	6.	5.	1.86
106	2.	1.	21.	8.	7.	6.	2.22
107	2.	1.	13.	7.	[illegible]	5.	1.98
109	2.	1.	19.	8.	6.	[illegible]	[illegible]
111	2.	2.	18.	8.	7.	6.	1.98
112	2.	2.	18.	9.	7.	6.	1.96

INSTALLATION TEST CASE

STATISTICAL DATA FOR SELECTED RECEPTORS

ANNUAL PARTICULATES

MICROGRAMS PER CUBIC METER

AVERAGING TIME 8. HOURS

RECEPTOR NUMBER	EXPECTED STATISTICAL PARAMETERS						STANDARD GEOMETRIC DEVIATION
	ARITHMETIC MEAN	GEOMETRIC MEAN	MAXIMUM CONCENTRATION	1.0 % CONCENTRATION	2.0 % CONCENTRATION	3.0 % CONCENTRATION	
55	2.	1.	10.	6.	5.	4.	1.78
64	2.	2.	11.	7.	6.	5.	1.78
101	2.	2.	13.	8.	7.	6.	1.78
102	3.	2.	13.	8.	7.	6.	1.75
103	3.	2.	15.	8.	7.	6.	1.81
104	2.	2.	11.	7.	6.	5.	1.73
105	2.	2.	11.	7.	6.	5.	1.81
106	2.	1.	16.	8.	7.	6.	2.14
107	2.	1.	12.	6.	5.	5.	1.92
109	2.	1.	15.	7.	6.	5.	2.13
111	2.	2.	15.	8.	7.	6.	1.92
112	2.	2.	15.	8.	7.	6.	1.90

INSTALLATION TEST CASE

STATISTICAL DATA FOR SELECTED RECEPTORS

ANNUAL PARTICULATES

MICROGRAMS PER CUBIC METER

AVERAGING TIME 24. HOURS

RECEPTOR NUMBER	EXPECTED STATISTICAL PARAMETERS						STANDARD GEOMETRIC DEVIATION
	ARITHMETIC MEAN	GEOMETRIC MEAN	MAXIMUM CONCENTRATION	1.0 % CONCENTRATION	2.0 % CONCENTRATION	3.0 % CONCENTRATION	
55	2.	2.	7.	5.	5.	4.	1.70
64	2.	2.	8.	6.	5.	5.	1.70
101	2.	2.	10.	7.	6.	6.	1.70
102	3.	2.	10.	7.	6.	6.	1.67
103	3.	2.	11.	8.	7.	6.	1.72
104	2.	2.	9.	6.	6.	5.	1.65
105	2.	2.	8.	6.	5.	5.	1.72
106	2.	1.	11.	7.	6.	5.	2.01
107	2.	1.	8.	6.	5.	4.	1.82
109	2.	1.	10.	7.	6.	5.	2.00
111	2.	2.	11.	7.	6.	6.	1.82
112	2.	2.	11.	7.	6.	6.	1.80

Figure 9-34.

03/19/70

INSTALLATION TEST CASE

CONTROL STRATEGY SUMMARY

JURISDICTION AND NUMBER	TOTAL APPLICABLE POINT SOURCES	TOTAL CONTROLLED POINT SOURCES	EXISTING EMISSIONS FOR POINT SOURCES (TONS/DAY)	EMISSION REDUCTION (TONS/DAY)	ANNUAL CONTROL COST (MILLIONS OF $)	CONTROL COST PER TON REMOVED ($/TON)
MISSOURI 1	11	7	55.02	50.55	0.416	22.57
ILLINOIS 2	12	7	53.04	37.57	0.763	55.64
STRATEGY TOTAL	23	14	108.06	88.12	1.179	36.67

(*) SOME SOURCES COULD NOT ATTAIN THE ALLOWABLE EMISSION
(**) NO DEVICE AVALILABLE TO CONTROL SOME SOURCES.

```
                         INSTALLATION TEST CASE                                  03/19/70
                C O N T R O L   S T R A T E G Y   S U M M A R Y


                        R E G I O N A L   E M I S S I O N S
                       -------------------------------------

EXISTING EMISSIONS IN TONS/DAY                        CONTROLLED EMISSIONS IN TONS/DAY
   POINT SOURCES....  108.1                               POINT SOURCES....  19.9
   AREA SOURCES.....   23.6                               AREA SOURCES.....  23.6
                     --------                                               -------
   TOTAL EMISSIONS..  131.7                               TOTAL EMISSIONS..  43.5
 TONS/DAY REMOVED....  88.1                          PERCENTAGE REDUCTION.......66.9 %


           R E G I O N A L   C O N T R O L   C O S T - E F F E C T I V E N E S S
          -----------------------------------------------------------------------

REDUCTION IN TOTAL EMISSION RATE . . . . . . . . . . . . . . . . .    36.67 DOLLARS/TON
REDUCTION IN GROUND LEVEL CONCENTRATION . . .  364742.81 DOLLARS/MICROGRAM/CUBIC METER
```

Figure 9-35.

INSTALLATION TEST CASE 03/19/70

REGULATION EFFECTS ON

SOURCE EMISSIONS

FUEL COMBUSTION REGULATION 1 FOR SULFUR DIOXIDE CONTROL
MISSOURI JURISDICTION

SIC CODE	SITE NUMBER	DEVICE ID	ANNUAL DEVICE COST	DEVICE EFFICIENCY	EMISSIONS (TONS/DAY)		
					EXISTING	ALLOWABLE	CONTROLLED
2819	340	27	$ 121647.00	0.38462	20.36	12.53	12.53
3742	2400	27	$ 11042.80	0.40157	1.60	0.96	0.96
4911	50	28	$ 1232290.00	0.70110	192.08	89.13	57.41

(*) INDICATES MOST EFFICIENT DEVICE WAS USED BUT ALLOWABLE WAS NOT ATTAINED.
(**) INDICATES NO DEVICE AVAILABLE TO CONTROL THE SOURCE

INSTALLATION TEST CASE 03/19/78

REGULATION EFFECTS ON
SOURCE EMISSIONS

INDUSTRIAL PROCESS REGULATION 1 FOR SULFUR DIOXIDE CONTROL
MISSOURI JURISDICTION

SIC CODE	SITE NUMBER	DEVICE ID	ANNUAL DEVICE COST	DEVICE EFFICIENCY	EMISSIONS (TONS/DAY)		
					EXISTING	ALLOWABLE	CONTROLLED
2819	341	13	* 110857.00	0.80000	23.70	7.04	4.74
3332	2701	44	* -1412730.00	0.99500	203.00	11.39	1.02

(*) INDICATES MOST EFFICIENT DEVICE WAS USED BUT ALLOWABLE WAS NOT ATTAINED.
(**) INDICATES NO DEVICE AVAILABLE TO CONTROL THE SOURCE

Figure 9-36.

```
                         INSTALLATION TEST CASE                                  03/19/78

                   J U R I S D I C T I O N   S U M M A R Y

                        MISSOURI       JURISDICTION

-------------------------------------------------------------------------------------------------------------
| REGULATION TYPE  |   TOTAL       |   TOTAL         | EXISTING EMISSIONS | EMISSION   |     ANNUAL       | CONTROL COST    |
|                  |  APPLICABLE   |  CONTROLLED     |        FOR         | REDUCTION  |  CONTROL COST    |   PER TON       |
|   AND NUMBER     | POINT SOURCES | POINT SOURCES   |   POINT SOURCES    | (TONS/DAY) | (MILLIONS OF $)  | REMOVED ($/TON) |
|                  |               |                 |    (TONS/DAY)      |            |                  |                 |
-------------------------------------------------------------------------------------------------------------
|   FUEL COMBUSTION|      3        |       3         |      214.04        |   143.14   |      1.365       |       26.13     |
|       1          |               |                 |                    |            |                  |                 |
| INDUSTRIAL PROCESS|     2        |       2         |      226.70        |   220.94   |     -1.294       |      -16.04     |
|       1          |               |                 |                    |            |                  |                 |
-------------------------------------------------------------------------------------------------------------
| JURISDICTION TOTAL|     5        |       5         |      440.74        |   364.08   |      0.071       |        0.54     |
-------------------------------------------------------------------------------------------------------------
                         (*) SOME SOURCES COULD NOT ATTAIN THE ALLOWABLE EMISSION
                           (**) NO DEVICE AVAILABLE  TO CONTROL SOME SOURCES.


                      J U R I S D I C T I O N   E M I S S I O N S
                      -------------------------------------------

      EXISTING EMISSIONS IN TONS/DAY                    CONTROLLED EMISSIONS IN TONS/DAY

         POINT SOURCES.....  440.7                          POINT SOURCES.....  76.7

         AREA SOURCES......    0.0                          AREA SOURCES......   0.0
                             -------                                           -----

         TOTAL EMISSIONS..  440.7                           TOTAL EMISSIONS..  76.7

       TONS/DAY REMOVED.... 364.1                       PERCENTAGE REDUCTION.......82.6 %


          J U R I S D I C T I O N   C O N T R O L   C O S T - E F F E C T I V E N E S S
          ------------------------------------------------------------------------------

      REDUCTION IN TOTAL EMISSION RATE . . . . . . . . . . . . . . . . . .     0.54 DOLLARS/TON
```

```
                                   Figure 9-37.
                                                                                    03/19/70
                               INSTALLATION TEST CASE

                         R E G U L A T I O N   E F F E C T S   O N

                               S O U R C E   E M I S S I O N S

                    FUEL COMBUSTION REGULATION   1 FOR SULFUR DIOXIDE CONTROL
                                   ILLINOIS      JURISDICTION

---------------------------------------------------------------------------------------------------
| SIC  | SITE   | DEVICE |     ANNUAL      |   DEVICE   |          EMISSIONS (TONS/DAY)            |
|      |        |        |                 |            |------------------------------------------|
| CODE | NUMBER |   ID   |   DEVICE COST   | EFFICIENCY |  EXISTING  |  ALLOWABLE  |  CONTROLLED  |
|------|--------|--------|-----------------|------------|------------|-------------|--------------|
| 2800 |   410  |    27  | $    184388.00  |  0.40211   |     26.74  |     15.99   |      15.99   |
| 2819 |   330  |    27  | $    199164.00  |  0.45507   |     31.69  |     17.27   |      17.27   |
| 3323 |   710  |    16  | $     75513.88  |  0.0       |      6.19  |     62.78   |       6.19   |
| 4911 |    60  |    27  | $     15202.30  |  0.40204   |      3.59  |      2.15   |       2.15   |
| 4911 |    70  |    28  | $   2427360.00  |  0.68942   |    377.20  |    182.29   |     117.15   |
---------------------------------------------------------------------------------------------------
                (*) INDICATES MOST EFFICIENT DEVICE WAS USED BUT ALLOWABLE WAS NOT ATTAINED.
                (**) INDICATES NO DEVICE AVAILABLE TO CONTROL THE SOURCE
```

```
                              INSTALLATION TEST CASE                              03/19/70

                    R E G U L A T I O N   E F F E C T S   O N

                          S O U R C E   E M I S S I O N S

                   INDUSTRIAL PROCESS REGULATION   1 FOR SULFUR DIOXIDE CONTROL
                                          ILLINOIS      JURISDICTION

---------------------------------------------------------------------------------------------------
|  SIC   |  SITE   | DEVICE |    ANNUAL       |    DEVICE     |        EMISSIONS (TONS/DAY)       |
|        |         |        |                 |               |-----------------------------------|
|  CODE  | NUMBER  |   ID   |  DEVICE COST    |  EFFICIENCY   |-----------------------------------|
|--------|---------|--------|-----------------|---------------|  EXISTING | ALLOWABLE | CONTROLLED |
|        |         |        |                 |               |           |           |            |
|  2819  |   331   |     13 | $   105350.00   |    0.80000    |     19.10 |      7.02 |       3.82 |
                  (*) INDICATES MOST EFFICIENT DEVICE WAS USED BUT ALLOWABLE WAS NOT ATTAINED.
                  (**) INDICATES NO DEVICE AVAILABLE TO CONTROL THE SOURCE
```

Figure 9-38.

```
                               INSTALLATION TEST CASE                                       03/10/78

                         J U R I S D I C T I O N   S U M M A R Y

                              ILLINOIS       JURISDICTION

 -------------------------------------------------------------------------------------------------------
 | REGULATION TYPE   |     TOTAL       |      TOTAL      | EXISTING EMISSIONS |  EMISSION  |     ANNUAL        |  CONTROL COST   |
 |                   |   APPLICABLE    |   CONTROLLED    |        FOR         | REDUCTION  |   CONTROL COST    |    PER TON      |
 |   AND NUMBER      | POINT SOURCES   | POINT SOURCES   |   POINT SOURCES    | (TONS/DAY) | (MILLIONS OF $)   | REMOVED ($/TON) |
 |                   |                 |                 |     (TONS/DAY)     |            |                   |                 |
 -------------------------------------------------------------------------------------------------------
 |   FUEL COMBUSTION |        5        |        5        |       445.41       |    286.67  |       2.902       |       27.73     |
 |        1          |                 |                 |                    |            |                   |                 |
 |INDUSTRIAL PROCESS |        1        |        1        |        19.10       |     15.28  |       0.105       |       18.89     |
 |        1          |                 |                 |                    |            |                   |                 |
 |                   |                 |                 |                    |            |                   |                 |
 -------------------------------------------------------------------------------------------------------
 | JURISDICTION TOTAL|        6        |        6        |       464.51       |    301.95  |       3.007       |       27.28     |
 -------------------------------------------------------------------------------------------------------
                            (*) SOME SOURCES COULD NOT ATTAIN THE ALLOWABLE EMISSION
                              (**) NO DEVICE AVAILABLE  TO CONTROL SOME SOURCES.


                        J U R I S D I C T I O N   E M I S S I O N S
                        -------------------------------------------

          EXISTING EMISSIONS IN TONS/DAY                         CONTROLLED EMISSIONS IN TONS/DAY

            POINT SOURCES....  464.5                                POINT SOURCES.... 162.6

            AREA SOURCES.....    0.0                                AREA SOURCES.....   0.0
                               --------                                               --------

            TOTAL EMISSIONS..  464.5                                TOTAL EMISSIONS.. 162.6

          TONS/DAY REMOVED.... 301.9                             PERCENTAGE REDUCTION.......65.0 %


                  J U R I S D I C T I O N   C O N T R O L   C O S T - E F F E C T I V E N E S S
                  -----------------------------------------------------------------------------

          REDUCTION IN TOTAL EMISSION RATE . . . . . . . . . . . . . . . . . .    27.28 DOLLARS/TON
```

Figure 9-39.

```
                          INSTALLATION TEST CASE                                03/19/70

                        CONTROL STRATEGY EFFECTS ON
                        CONCENTRATIONS AT GROUND LEVEL

AIR QUALITY STANDARD   20.0    MICROGRAMS/CUBIC METER
-------------------------------------------------------------------------------------------------------
| RECEPTOR |          LOCATIONS          | NEW CONCENTRATION VALUE|     AMOUNT REDUCED      |    AMOUNT IN EXCESS.   |
|          |       UTM,KILOMETERS        |                        |                         |                        |
|_NUMBER___|______X______|_______Y_______|_MICROGRAMS/CUBIC METER|_MICROGRAMS/CUBIC METER|_MICROGRAMS/CUBIC METER|
|    1     |     0.0     |      0.0      |     0.587390E 01       |     0.239479E 01        |     0.0                |
|    2     |     0.0     |     15.00     |     0.674221E 01       |     0.320353E 01        |     0.0                |
|    3     |     0.0     |     30.00     |     0.773368E 01       |     0.377945E 01        |     0.0                |
|    4     |     0.0     |     45.00     |     0.824130E 01       |     0.414855E 01        |     0.0                |
|    5     |     0.0     |     60.00     |     0.871174E 01       |     0.409180E 01        |     0.0                |
|    6     |     0.0     |     75.00     |     0.882488E 01       |     0.402750E 01        |     0.0                |
|    7     |     0.0     |     90.00     |     0.840401E 01       |     0.388577E 01        |     0.0                |
|    8     |     0.0     |    105.00     |     0.790151E 01       |     0.359847E 01        |     0.0                |
|    9     |     0.0     |    120.00     |     0.703096E 01       |     0.329925E 01        |     0.0                |
|   10     |     0.0     |    135.00     |     0.648100E 01       |     0.289668E 01        |     0.0                |
|   11     |     0.0     |    150.00     |     0.600506E 01       |     0.251383E 01        |     0.0                |
|   12     |    15.00    |      0.0      |     0.598369E 01       |     0.281987E 01        |     0.0                |
|   13     |    15.00    |     15.00     |     0.708448E 01       |     0.407521E 01        |     0.0                |
|   14     |    15.00    |     30.00     |     0.820099E 01       |     0.504347E 01        |     0.0                |
|   15     |    15.00    |     45.00     |     0.883784E 01       |     0.524705E 01        |     0.0                |
|   16     |    15.00    |     60.00     |     0.934994E 01       |     0.502507E 01        |     0.0                |
|   17     |    15.00    |     75.00     |     0.944187E 01       |     0.464136E 01        |     0.0                |
|   18     |    15.00    |     90.00     |     0.903281E 01       |     0.434411E 01        |     0.0                |
|   19     |    15.00    |    105.00     |     0.806239E 01       |     0.391893E 01        |     0.0                |
|   20     |    15.00    |    120.00     |     0.714703E 01       |     0.351483E 01        |     0.0                |
|   21     |    15.00    |    135.00     |     0.650751E 01       |     0.299777E 01        |     0.0                |
|   22     |    15.00    |    150.00     |     0.590926E 01       |     0.251886E 01        |     0.0                |
|   23     |    30.00    |      0.0      |     0.609011E 01       |     0.343589E 01        |     0.0                |
|   24     |    30.00    |     15.00     |     0.744221E 01       |     0.524002E 01        |     0.0                |
|   25     |    30.00    |     30.00     |     0.903720E 01       |     0.683988E 01        |     0.0                |
|   26     |    30.00    |     45.00     |     0.961452E 01       |     0.694111E 01        |     0.0                |
|   27     |    30.00    |     60.00     |     0.101157E 02       |     0.636832E 01        |     0.0                |
|   28     |    30.00    |     75.00     |     0.104331E 02       |     0.540784E 01        |     0.0                |
|   29     |    30.00    |     90.00     |     0.987079E 01       |     0.466685E 01        |     0.0                |
|   30     |    30.00    |    105.00     |     0.822650E 01       |     0.418858E 01        |     0.0                |
|   31     |    30.00    |    120.00     |     0.729861E 01       |     0.381040E 01        |     0.0                |
|   32     |    30.00    |    135.00     |     0.643114E 01       |     0.323278E 01        |     0.0                |
|   33     |    30.00    |    150.00     |     0.599184E 01       |     0.266628E 01        |     0.0                |
|   34     |    45.00    |      0.0      |     0.625390E 01       |     0.413002E 01        |     0.0                |
|   35     |    45.00    |     15.00     |     0.773870E 01       |     0.695457E 01        |     0.0                |
|   36     |    45.00    |     30.00     |     0.106449E 02       |     0.103219E 02        |     0.0                |
|   37     |    45.00    |     45.00     |     0.101102E 02       |     0.107804E 02        |     0.0                |
|   38     |    45.00    |     60.00     |     0.115332E 02       |     0.100870E 02        |     0.0                |
|   39     |    45.00    |     75.00     |     0.122014E 02       |     0.736707E 01        |     0.0                |
|   40     |    45.00    |     90.00     |     0.104957E 02       |     0.473910E 01        |     0.0                |
|   41     |    45.00    |    105.00     |     0.965914E 01       |     0.502035E 01        |     0.0                |
                                        INSTALLATION TEST CASE                                      03/19/70

                                      CONTROL STRATEGY EFFECTS ON
                                      CONCENTRATIONS AT GROUND LEVEL

AIR QUALITY STANDARD   20.0    MICROGRAMS/CUBIC METER
-----------------------------------------------------------------------------------------------------------------
| RECEPTOR |          LOCATIONS          | NEW CONCENTRATION VALUE|     AMOUNT REDUCED       |   AMOUNT IN EXCESS    |
|          |       UTM,KILOMETERS        |                        |                          |                       |
| NUMBER   |       X       |       Y     | MICROGRAMS/CUBIC METER | MICROGRAMS/CUBIC METER   | MICROGRAMS/CUBIC METER|
|    42    |     45.00     |    120.00   |     0.739998E 01       |     0.457660E 01         |    0.0                |
|    43    |     45.00     |    135.00   |     0.647613E 01       |     0.354161E 01         |    0.0                |
|    44    |     45.00     |    150.00   |     0.602217E 01       |     0.296239E 01         |    0.0                |
|    45    |     60.00     |      0.0    |     0.704784E 01       |     0.584971E 01         |    0.0                |
|    46    |     60.00     |     15.00   |     0.859167E 01       |     0.104707E 02         |    0.0                |
|    47    |     60.00     |     30.00   |     0.157200E 02       |     0.260467E 02         |    0.0                |
|    48    |     60.00     |     45.00   |     0.104147E 02       |     0.145405E 02         |    0.0                |
|    49    |     60.00     |     60.00   |     0.133694E 02       |     0.124563E 02         |    0.0                |
|    50    |     60.00     |     75.00   |     0.146475E 02       |     0.104378E 02         |    0.0                |
|    51    |     60.00     |     90.00   |     0.113677E 02       |     0.725052E 01         |    0.0                |
|    52    |     60.00     |    105.00   |     0.937976E 01       |     0.802959E 01         |    0.0                |
|    53    |     60.00     |    120.00   |     0.757142E 01       |     0.535998E 01         |    0.0                |
|    54    |     60.00     |    135.00   |     0.660423E 01       |     0.383248E 01         |    0.0                |
|    55    |     60.00     |    150.00   |     0.605923E 01       |     0.308914E 01         |    0.0                |
|    56    |     75.00     |      0.0    |     0.107866E 02       |     0.131068E 02         |    0.0                |
|    57    |     75.00     |     15.00   |     0.157221E 02       |     0.320433E 02         |    0.0                |
|    58    |     75.00     |     30.00   |     0.140440E 02       |     0.135698E 02         |    0.0                |
|    59    |     75.00     |     45.00   |     0.133613E 02       |     0.144982E 02         |    0.0                |
|    60    |     75.00     |     60.00   |     0.212317E 02       |     0.302404E 02         |    0.123172E 01       |
|    61    |     75.00     |     75.00   |     0.184814E 02       |     0.161813E 02         |    0.0                |
|    62    |     75.00     |     90.00   |     0.122865E 02       |     0.110665E 02         |    0.0                |
|    63    |     75.00     |    105.00   |     0.904551E 01       |     0.606552E 01         |    0.0                |
|    64    |     75.00     |    120.00   |     0.764224E 01       |     0.518874E 01         |    0.0                |
|    65    |     75.00     |    135.00   |     0.667848E 01       |     0.376117E 01         |    0.0                |
|    66    |     75.00     |    150.00   |     0.615047E 01       |     0.297832E 01         |    0.0                |
|    67    |     90.00     |      0.0    |     0.108478E 02       |     0.837041E 01         |    0.0                |
|    68    |     90.00     |     15.00   |     0.133713E 02       |     0.114829E 02         |    0.0                |
|    69    |     90.00     |     30.00   |     0.134892E 02       |     0.127941E 02         |    0.0                |
|    70    |     90.00     |     45.00   |     0.165952E 02       |     0.151479E 02         |    0.0                |
|    71    |     90.00     |     60.00   |     0.270299E 02       |     0.353034E 02         |    0.702895E 01       |
|    72    |     90.00     |     75.00   |     0.187064E 02       |     0.110448E 02         |    0.0                |
|    73    |     90.00     |     90.00   |     0.107015E 02       |     0.643216E 01         |    0.0                |
|    74    |     90.00     |    105.00   |     0.869488E 01       |     0.375217E 01         |    0.0                |
|    75    |     90.00     |    120.00   |     0.737604E 01       |     0.293781E 01         |    0.0                |
|    76    |     90.00     |    135.00   |     0.666397E 01       |     0.261928E 01         |    0.0                |
|    77    |     90.00     |    150.00   |     0.620136E 01       |     0.233210E 01         |    0.0                |
|    78    |    105.00     |      0.0    |     0.100970E 02       |     0.615871E 01         |    0.0                |
|    79    |    105.00     |     15.00   |     0.108018E 02       |     0.626462E 01         |    0.0                |
|    80    |    105.00     |     30.00   |     0.114065E 02       |     0.704820E 01         |    0.0                |
|    81    |    105.00     |     45.00   |     0.130275E 02       |     0.740788E 01         |    0.0                |
|    82    |    105.00     |     60.00   |     0.130479E 02       |     0.665901E 01         |    0.0                |
                                      INSTALLATION TEST CASE                                        03/19/70

                                   CONTROL STRATEGY EFFECTS ON
                                   CONCENTRATIONS AT GROUND LEVEL

AIR QUALITY STANDARD   20.0   MICROGRAMS/CUBIC METER
-----------------------------------------------------------------------------------------------------------------
| RECEPTOR |          LOCATIONS           | NEW CONCENTRATION VALUE|     AMOUNT REDUCED      |    AMOUNT IN EXCESS    |
|          |       UTM,KILOMETERS         |                        |                         |                        |
|_NUMBER___|_______X_______|_______Y______|_MICROGRAMS/CUBIC METER|_MICROGRAMS/CUBIC METER|_MICROGRAMS/CUBIC METER|
|    83    |     105.00    |      75.00   |     0.956301E 01       |      0.396848E 01       |     0.0                |
|    84    |     105.00    |      90.00   |     0.832925E 01       |      0.333525E 01       |     0.0                |
|    85    |     105.00    |     105.00   |     0.761437E 01       |      0.277516E 01       |     0.0                |
|    86    |     105.00    |     120.00   |     0.697232E 01       |      0.207010E 01       |     0.0                |
|    87    |     105.00    |     135.00   |     0.649575E 01       |      0.185128E 01       |     0.0                |
|    88    |     105.00    |     150.00   |     0.612635E 01       |      0.177614E 01       |     0.0                |
|    89    |     120.00    |       0.0    |     0.902881E 01       |      0.494675E 01       |     0.0                |
|    90    |     120.00    |      15.00   |     0.941461E 01       |      0.506112E 01       |     0.0                |
|    91    |     120.00    |      30.00   |     0.998910E 01       |      0.415298E 01       |     0.0                |
|    92    |     120.00    |      45.00   |     0.106869E 02       |      0.464445E 01       |     0.0                |
|    93    |     120.00    |      60.00   |     0.972850E 01       |      0.374812E 01       |     0.0                |
|    94    |     120.00    |      75.00   |     0.772274E 01       |      0.254560E 01       |     0.0                |
|    95    |     120.00    |      90.00   |     0.693454E 01       |      0.210715E 01       |     0.0                |
|    96    |     120.00    |     105.00   |     0.641057E 01       |      0.191582E 01       |     0.0                |
|    97    |     120.00    |     120.00   |     0.618731E 01       |      0.156134E 01       |     0.0                |
|    98    |     120.00    |     135.C0   |     0.607534E 01       |      0.138573E 01       |     0.0                |
|    99    |     120.00    |     150.00   |     0.593461E 01       |      0.127815E 01       |     0.0                |
|   100    |     135.00    |       0.0    |     0.828114E 01       |      0.381298E 01       |     0.0                |
|   101    |     135.00    |      15.00   |     0.860264E 01       |      0.330125E 01       |     0.0                |
|   102    |     135.00    |      30.00   |     0.870833E 01       |      0.259730E 01       |     0.0                |
|   1C3    |     135.00    |      45.00   |     0.874780E 01       |      0.228602E 01       |     0.0                |
|   104    |     135.00    |      60.00   |     0.775171E 01       |      0.185679E 01       |     0.0                |
|   105    |     135.00    |      75.00   |     0.674286E 01       |      0.159702E 01       |     0.0                |
|   106    |     135.00    |      90.00   |     0.599652E 01       |      0.129516E 01       |     0.0                |
|   107    |     135.00    |     105.00   |     0.560889E 01       |      0.115418E 01       |     0.0                |
|   108    |     135.00    |     120.0C   |     0.554971E 01       |      0.117206E 01       |     0.0                |
|   109    |     135.00    |     135.00   |     0.552965E 01       |      0.110862E 01       |     0.0                |
|   110    |     135.00    |     150.00   |     0.549568E 01       |      0.101449E 01       |     0.0                |
|   111    |     150.00    |       0.0    |     0.776769E 01       |      0.270455E 01       |     0.0                |
|   112    |     150.00    |      15.00   |     0.783123E 01       |      0.229833E 01       |     0.0                |
|   113    |     150.00    |      30.00   |     0.770223E 01       |      0.205873E 01       |     0.0                |
|   114    |     150.00    |      45.00   |     0.756410E 01       |      0.183971E 01       |     0.0                |
|   115    |     150.00    |      60.00   |     0.672567E 01       |      0.148878E 01       |     0.0                |
|   116    |     150.00    |      75.00   |     0.606625E 01       |      0.120348E 01       |     0.0                |
|   117    |     150.00    |      90.00   |     0.557440E 01       |      0.105017E 01       |     0.0                |
|   118    |     150.00    |     105.00   |     0.518598E 01       |      0.873370E 00       |     0.0                |
|   119    |     150.00    |     120.00   |     0.509234E 01       |      0.750167E 00       |     0.0                |
|   120    |     150.00    |     135.00   |     0.512208E 01       |      0.851313E 00       |     0.0                |
|   121    |     150.00    |     150.00   |     0.515581E 01       |      0.844050E 00       |     0.0                |
|   122    |      40.00    |      40.00   |     0.985233E 01       |      0.899377E 01       |     0.0                |
|   123    |      40.00    |      80.00   |     0.111919E 02       |      0.534314E 01       |     0.0                |
                                INSTALLATION TEST CASE                                   03/19/78

                              CONTROL STRATEGY EFFECTS ON
                              CONCENTRATIONS AT GROUND LEVEL

AIR QUALITY STANDARD   20.0   MICROGRAMS/CUBIC METER
----------------------------------------------------------------------------------------------------
| RECEPTOR |        LOCATIONS         | NEW CONCENTRATION VALUE|     AMOUNT REDUCED      |     AMOUNT IN EXCESS      |
|          |     UTM,KILOMETERS       |                        |                         |                           |
| NUMBER   |     X      |      Y      | MICROGRAMS/CUBIC METER | MICROGRAMS/CUBIC METER  | MICROGRAMS/CUBIC METER    |
|   124    |    40.00   |    130.00   |     0.666401E 01       |     0.374263E 01        |     0.0                   |
|   125    |    80.00   |     40.00   |     0.152766E 02       |     0.158105E 02        |     0.0                   |
|   126    |    90.00   |     80.00   |     0.167180E 02       |     0.131895E 02        |     0.0                   |
|   127    |    80.00   |    130.00   |     0.693529E 01       |     0.360113E 01        |     0.0                   |
|   128    |   130.00   |     40.00   |     0.920795E 01       |     0.263489E 01        |     0.0                   |
|   129    |   130.00   |     80.00   |     0.693657E 01       |     0.202662E 01        |     0.0                   |
|   130    |   130.00   |    130.00   |     0.570732E 01       |     0.123518E 01        |     0.0                   |
```

Figure 9-40.

INSTALLATION TEST CASE

STATISTICAL DATA FOR SELECTED RECEPTORS

ANNUAL SO2

MICROGRAMS PER CUBIC METER

AVERAGING TIME 1. HOURS

RECEPTOR	EXPECTED STATISTICAL PARAMETERS						STANDARD
NUMBER	ARITHMETIC MEAN	GEOMETRIC MEAN	MAXIMUM CONCENTRATION	1.0 % CONCENTRATION	2.0 % CONCENTRATION	3.0 % CONCENTRATION	GEOMETRIC DEVIATION
34	6.	5.	77.	26.	21.	19.	2.07
55	6.	4.	92.	28.	23.	20.	2.22
64	8.	6.	94.	32.	26.	23.	2.07
101	9.	7.	109.	36.	30.	26.	2.09
102	9.	7.	105.	36.	30.	26.	2.06
103	9.	7.	115.	38.	31.	27.	2.12
104	8.	6.	90.	31.	26.	23.	2.03
106	6.	3.	195.	40.	30.	25.	2.89
107	6.	4.	96.	28.	22.	19.	2.30
109	6.	3.	167.	36.	27.	23.	2.81
111	8.	6.	123.	37.	30.	26.	2.25
112	8.	6.	119.	36.	29.	26.	2.22

INSTALLATION TEST CASE

STATISTICAL DATA FOR SELECTED RECEPTORS

ANNUAL SO2

MICROGRAMS PER CUBIC METER

AVERAGING TIME 8. HOURS

RECEPTOR NUMBER	EXPECTED STATISTICAL PARAMETERS						STANDARD GEOMETRIC DEVIATION
	ARITHMETIC MEAN	GEOMETRIC MEAN	MAXIMUM CONCENTRATION	1.0 % CONCENTRATION	2.0 % CONCENTRATION	3.0 % CONCENTRATION	
34	6.	5.	41.	23.	19.	17.	1.90
55	6.	5.	47.	24.	20.	18.	2.01
64	8.	6.	50.	28.	23.	21.	1.90
101	9.	7.	58.	31.	26.	24.	1.91
102	9.	7.	56.	31.	26.	23.	1.89
103	9.	7.	60.	33.	27.	24.	1.93
104	8.	6.	49.	27.	23.	21.	1.86
106	6.	4.	81.	34.	26.	22.	2.54
107	6.	4.	47.	25.	19.	17.	2.08
109	6.	4.	71.	30.	24.	20.	2.48
111	8.	6.	61.	32.	26.	23.	2.03
112	8.	6.	60.	31.	26.	23.	2.01

INSTALLATION TEST CASE

STATISTICAL DATA FOR SELECTED RECEPTORS

ANNUAL : SO2

MICROGRAMS PER CUBIC METER

AVERAGING TIME 24. HOURS

RECEPTOR NUMBER	EXPECTED STATISTICAL PARAMETERS						STANDARD GEOMETRIC DEVIATION
	ARITHMETIC MEAN	GEOMETRIC MEAN	MAXIMUM CONCENTRATION	1.0 % CONCENTRATION	2.0 % CONCENTRATION	3.0 % CONCENTRATION	
34	6.	5.	30.	21.	18.	16.	1.80
55	6.	5.	33.	22.	18.	16.	1.90
64	8.	6.	36.	25.	22.	19.	1.80
101	9.	7.	41.	29.	24.	22.	1.81
102	9.	7.	41.	28.	24.	22.	1.79
103	9.	7.	43.	30.	25.	23.	1.83
104	8.	7.	35.	25.	21.	19.	1.77
106	6.	4.	51.	30.	24.	21.	2.35
107	6.	4.	32.	21.	18.	16.	1.96
109	6.	4.	45.	27.	22.	19.	2.30
111	8.	6.	43.	29.	24.	21.	1.92
112	9.	6.	42.	28.	24.	21.	1.90

Figure 9-41.

INSTALLATION TEST CASE

03/19/70

CONTROL STRATEGY SUMMARY

JURISDICTION AND NUMBER	TOTAL APPLICABLE POINT SOURCES	TOTAL CONTROLLED POINT SOURCES	EXISTING EMISSIONS FOR POINT SOURCES (TONS/DAY)	EMISSION REDUCTION (TONS/DAY)	ANNUAL CONTROL COST (MILLIONS OF $)	CONTROL COST PER TON REMOVED ($/TON)
MISSOURI 1	5	5	440.74	364.08	0.071	0.54
ILLINOIS 2	6	6	464.51	301.95	3.007	27.28
STRATEGY TOTAL	11	11	905.25	666.03	3.078	12.66

(*) SOME SOURCES COULD NOT ATTAIN THE ALLOWABLE EMISSION
(**) NO DEVICE AVAILABLE TO CONTROL SOME SOURCES.

```
                                   INSTALLATION TEST CASE                                           03/19/70
                             C O N T R O L   S T R A T E G Y   S U M M A R Y



                                 R E G I O N A L   E M I S S I O N S
                                 -----------------------------------

         EXISTING EMISSIONS IN TONS/DAY                             CONTROLLED EMISSIONS IN TONS/DAY

           POINT SOURCES....  905.2                                     POINT SOURCES.... 239.2

           AREA SOURCES.....    0.0                                     AREA SOURCES.....   0.0
                              -------                                                     -------
           TOTAL EMISSIONS..  905.2                                     TOTAL EMISSIONS.. 239.2

          TONS/DAY REMOVED.... 666.0                               PERCENTAGE REDUCTION.......73.6 %


                        R E G I O N A L   C O N T R O L   C O S T - E F F E C T I V E N E S S
                        ---------------------------------------------------------------------

          REDUCTION IN TOTAL EMISSION RATE . . . . . . . . . . . . . . . . .     12.66 DOLLARS/TON

          REDUCTION IN GROUND LEVEL CONCENTRATION . . .  533525.69 DOLLARS/MICROGRAM/CUBIC METER
```

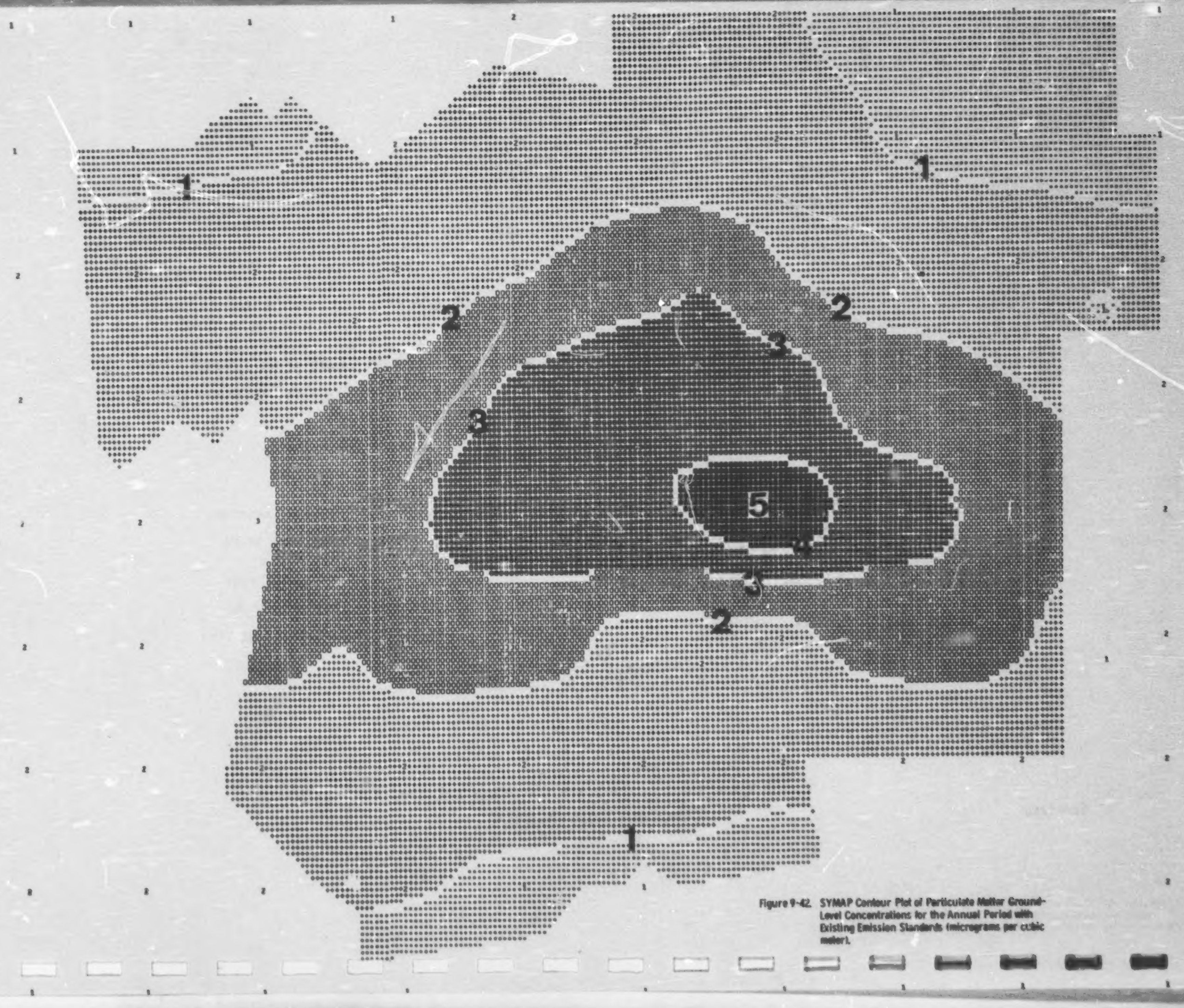


Figure 9-42. SYMAP Contour Plot of Particulate Matter Ground-Level Concentrations for the Annual Period with Existing Emission Standards (micrograms per cubic meter).

10.0 INSTALLATION TEST PLAN

10.1 PURPOSE

A computer program is of no use until it is properly installed on a computer. This Installation Test Plan is a step-by-step procedure for installing the Implementation Planning Program and verifying its proper operation. Upon completion of these procedures, the program can be used with confidence as a tool in regional air pollution analyses.

Included in the Plan are descriptions of the required computer facility, a reference to previous instructions for preparation of sample Test City computer program loadsheets (Chapter 8) from which punched cards are prepared, instructions for executing the program, and a reference to the previously presented descriptions of the sample Test City program outputs (Chapter 9). This output material will then allow the user to make a one-to-one correspondence check between expected results and the output of a specific program installation.

The user is urged to consult with systems programmers assigned to the computer facility at which the Implementation Planning Program is being installed. The programmers are in the best position to determine the adequacy of the available hardware and software and the operating instructions provided in the preparation of input data.

10.2 COMPUTER REQUIREMENTS

The design of the individual computer program models and the Information System is predicated upon the availability of a computer hardware and software configuration possessing the following (minimum) characteristics:

- IBM 360 Model 40
  Central processing unit with at least 256,000 bytes of core storage.
- An IBM 2314 disk module.
- An IBM 2401 Mod. II magnetic tape unit.
- A card reader/ punch and high-speed line printer.

- The full OS (version 17 or later), capable of supporting the above hardware configuration.
- Software support of FORTRAN G and COBOL F compilers.

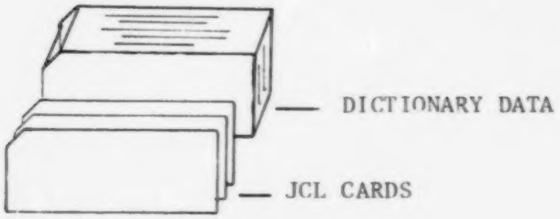
10.3 PREPARATION OF INPUT DATA

Three types of input data must be prepared for each installation of the Implementation Planning Program: (1) a data base containing information specific to a region, such as the emission inventory, meteorological factors, local fuel characteristics, etc.; (2) candidate emission control standards for use in control strategy analyses; and (3) various operating options to make use of the program's flexibility.

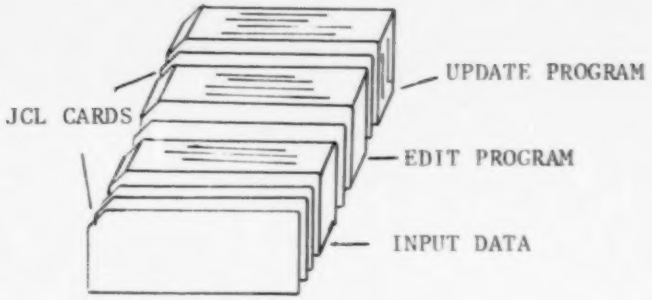
The description of Test City and the input data for this sample case are specified in Chapter 8. The user is instructed to prepare loadsheets in accordance with the Test City sample and have these sheets keypunched for input to the program. As shown in Chapter 8, the first set of loadsheets contains the data base information and is required in loading the disk file. Figure 10-1 illustrates the job-stream configuration of control cards, program cards, and data cards required to load the disk file.

The second set of loadsheets contains the program options and program control cards. Figures 10-2 through 10-8 illustrate the job-stream configuration of control cards and program cards required to execute each of the models, as well as the entire Implementation Planning Program.

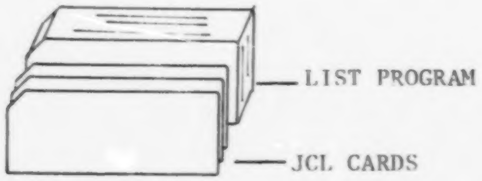
In both the preparation of the disk file and the execution of the program, the IBM System 360 Job Content Language (JCL) is used [IBM, 1969]. This language provides the user with a means of influencing the scheduling of computing operations and the allocation of computing resources.


DICTIONARY DATA
JCL CARDS

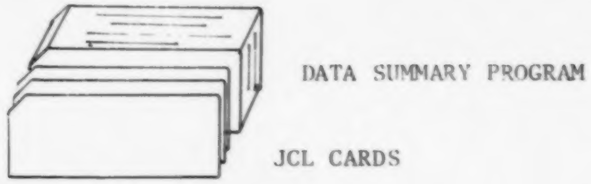
(A) DICTIONARY INPUT


UPDATE PROGRAM
JCL CARDS
EDIT PROGRAM
INPUT DATA

(B) DATA FILE INPUTS

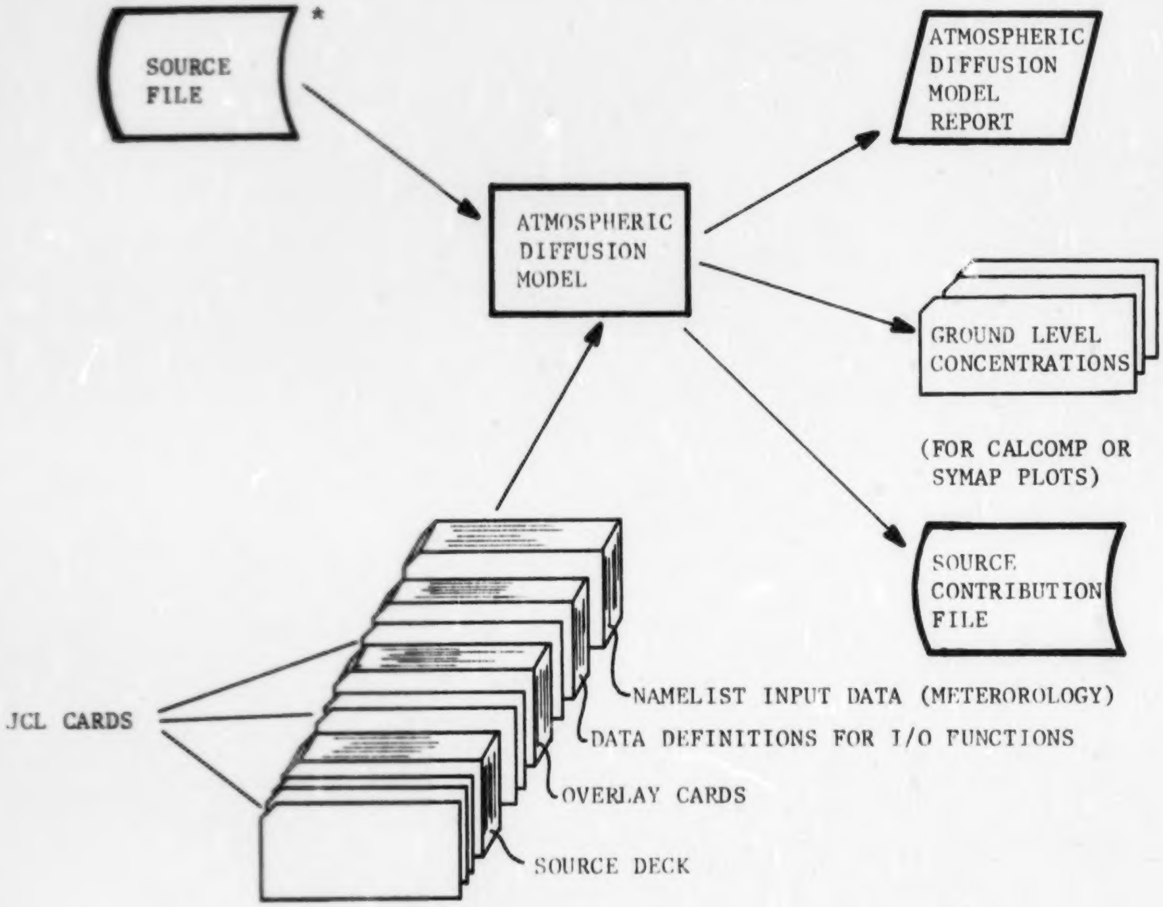

LIST PROGRAM
JCL CARDS

(C) DATA FILE LISTS


DATA SUMMARY PROGRAM
JCL CARDS

(D) DATA SUMMARY LISTS

Figure 10-1. Test Setup - Information System (Steps A, B, and C are repeated for each of the three files)


SOURCE FILE
*
ATMOSPHERIC DIFFUSION MODEL
ATMOSPHERIC DIFFUSION MODEL REPORT
GROUND LEVEL CONCENTRATIONS
(FOR CALCOMP OR SYMAP PLOTS)
SOURCE CONTRIBUTION FILE
JCL CARDS
NAMELIST INPUT DATA (METEROROLOGY)
DATA DEFINITIONS FOR I/O FUNCTIONS
OVERLAY CARDS
SOURCE DECK

*Disk file designations with a heavy left border indicate permanent files. Without border they indicate a temporary file for internal communications.

Figure 10-2. Test Setup - Atmospheric Diffusion Model

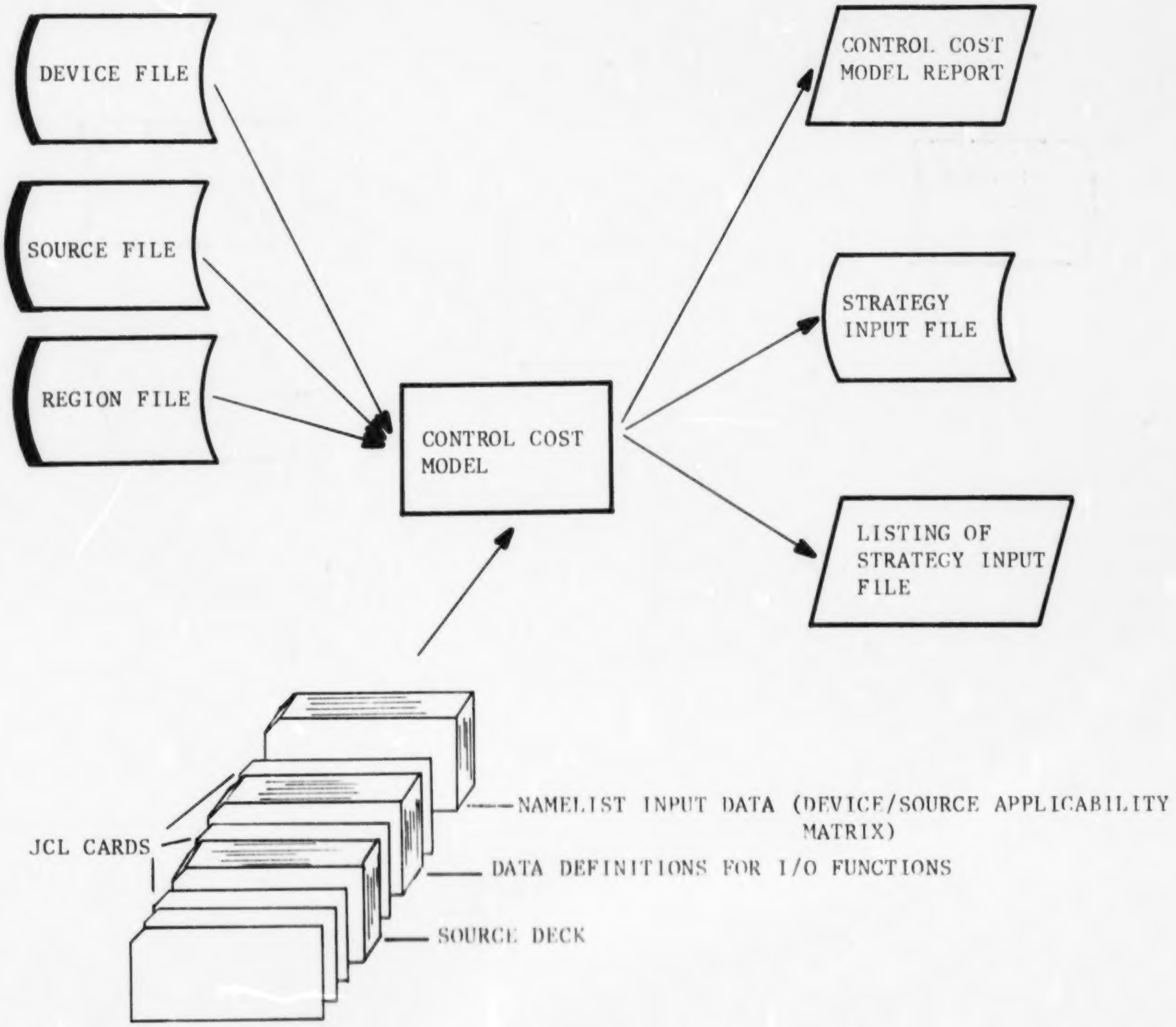

DEVICE FILE
SOURCE FILE
REGION FILE
CONTROL COST MODEL
CONTROL COST MODEL REPORT
STRATEGY INPUT FILE
LISTING OF STRATEGY INPUT FILE
NAMELIST INPUT DATA (DEVICE/SOURCE APPLICABILITY MATRIX)
JCL CARDS
DATA DEFINITIONS FOR I/O FUNCTIONS
SOURCE DECK

Figure 10-3. Test Setup - Control Cost Model

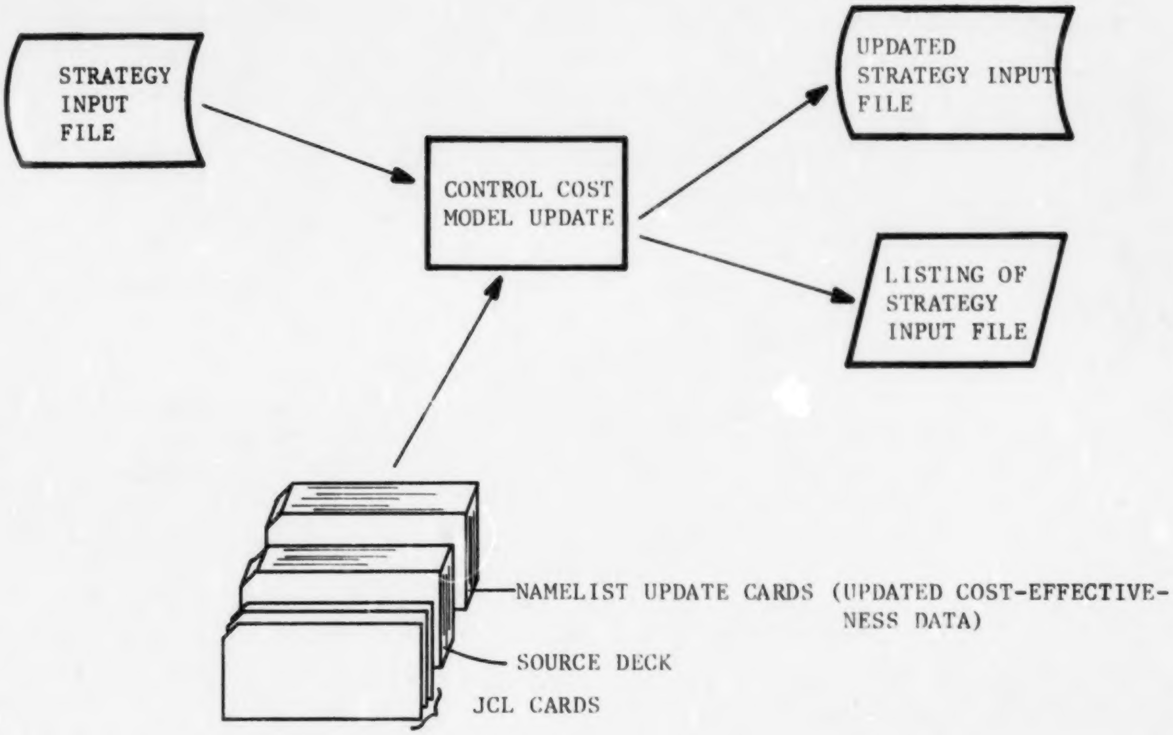

STRATEGY INPUT FILE
CONTROL COST MODEL UPDATE
UPDATED STRATEGY INPUT FILE
LISTING OF STRATEGY INPUT FILE
NAMELIST UPDATE CARDS (UPDATED COST-EFFECTIVENESS DATA)
SOURCE DECK
JCL CARDS

Figure 10-4. Test Setup - Control Cost Model, Update

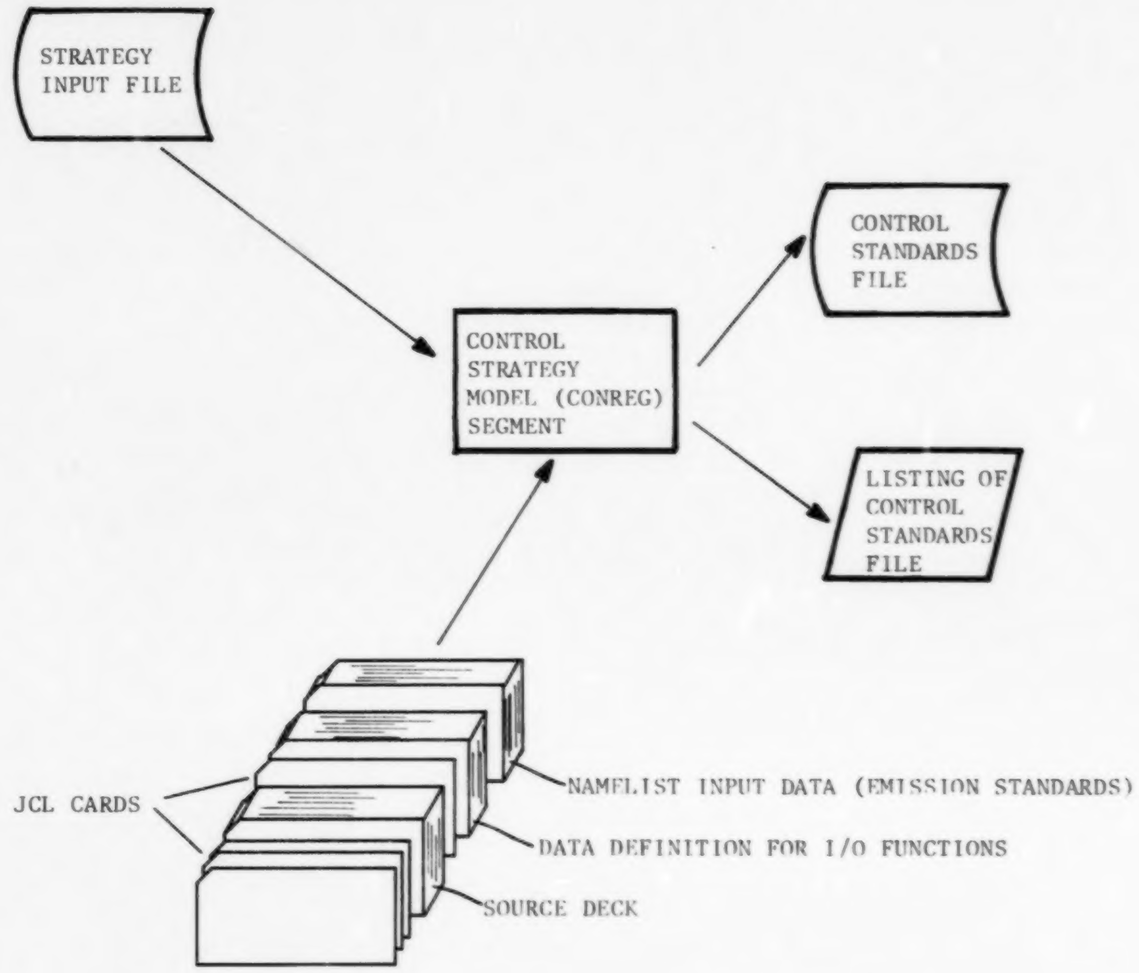

STRATEGY INPUT FILE
CONTROL STRATEGY MODEL (CONREG) SEGMENT
CONTROL STANDARDS FILE
LISTING OF CONTROL STANDARDS FILE
JCL CARDS
NAMELIST INPUT DATA (EMISSION STANDARDS)
DATA DEFINITION FOR I/O FUNCTIONS
SOURCE DECK

Figure 10-5. Test Setup - Control Strategy Model, Emission Standards Segment

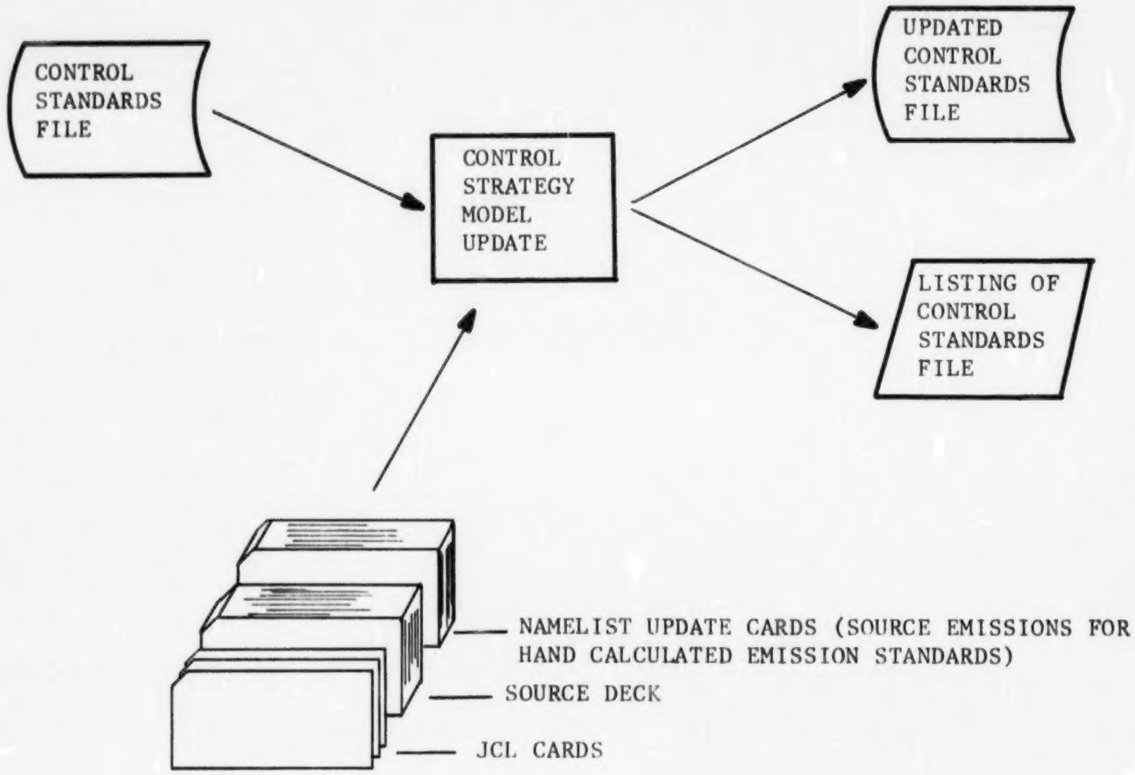

CONTROL
STANDARDS
FILE
CONTROL
STRATEGY
MODEL
UPDATE
UPDATED
CONTROL
STANDARDS
FILE
LISTING OF
CONTROL
STANDARDS
FILE
NAMELIST UPDATE CARDS (SOURCE EMISSIONS FOR HAND CALCULATED EMISSION STANDARDS)
SOURCE DECK
JCL CARDS

Figure 10-6. Test Setup - Control Strategy Model, Update

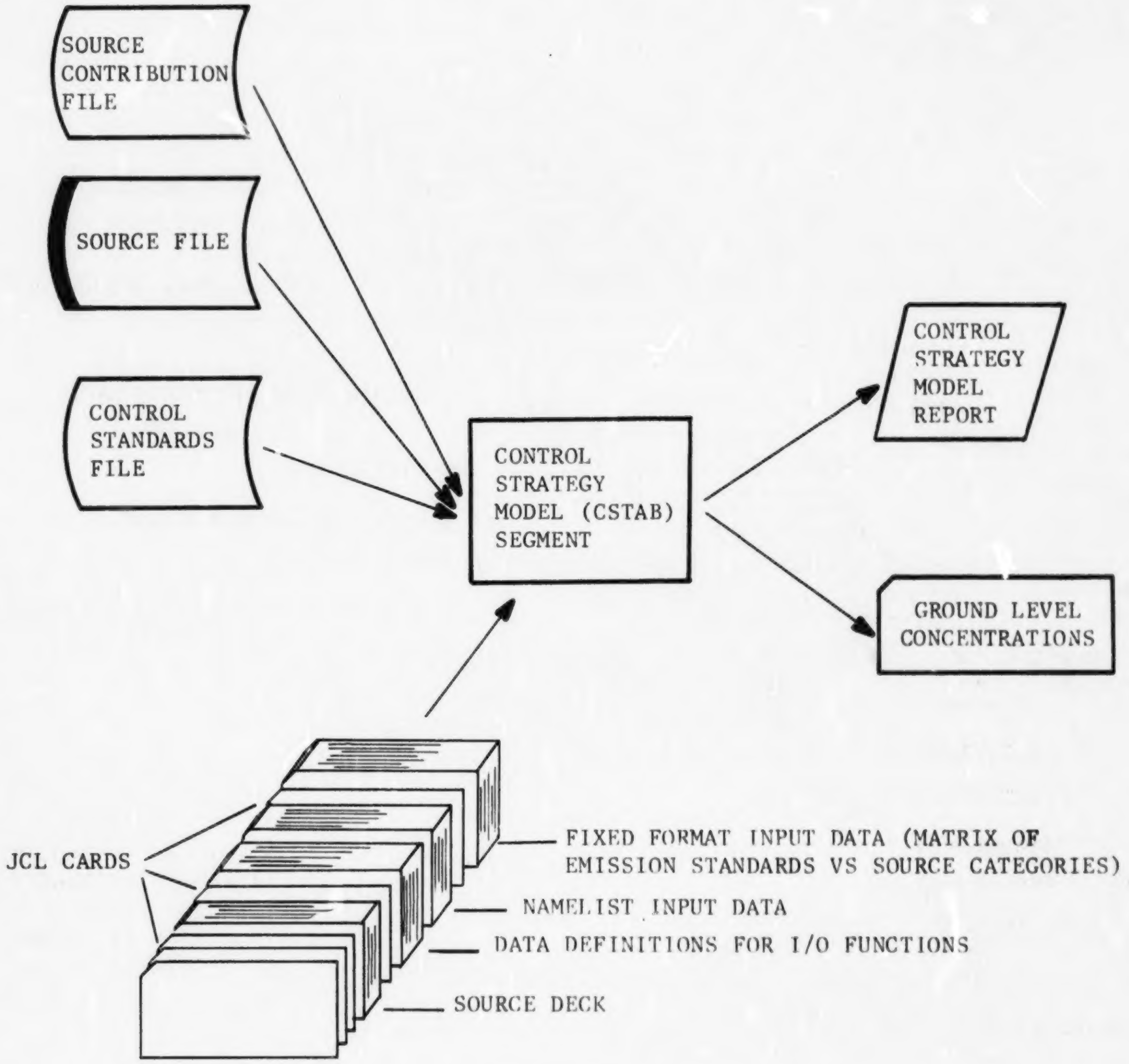

SOURCE CONTRIBUTION FILE
SOURCE FILE
CONTROL STANDARDS FILE
CONTROL STRATEGY MODEL (CSTAB) SEGMENT
CONTROL STRATEGY MODEL REPORT
GROUND LEVEL CONCENTRATIONS
JCL CARDS
FIXED FORMAT INPUT DATA (MATRIX OF EMISSION STANDARDS VS SOURCE CATEGORIES)
NAMELIST INPUT DATA
DATA DEFINITIONS FOR I/O FUNCTIONS
SOURCE DECK

Figure 10-7. Test Setup - Control Strategy Model, Strategy Segment

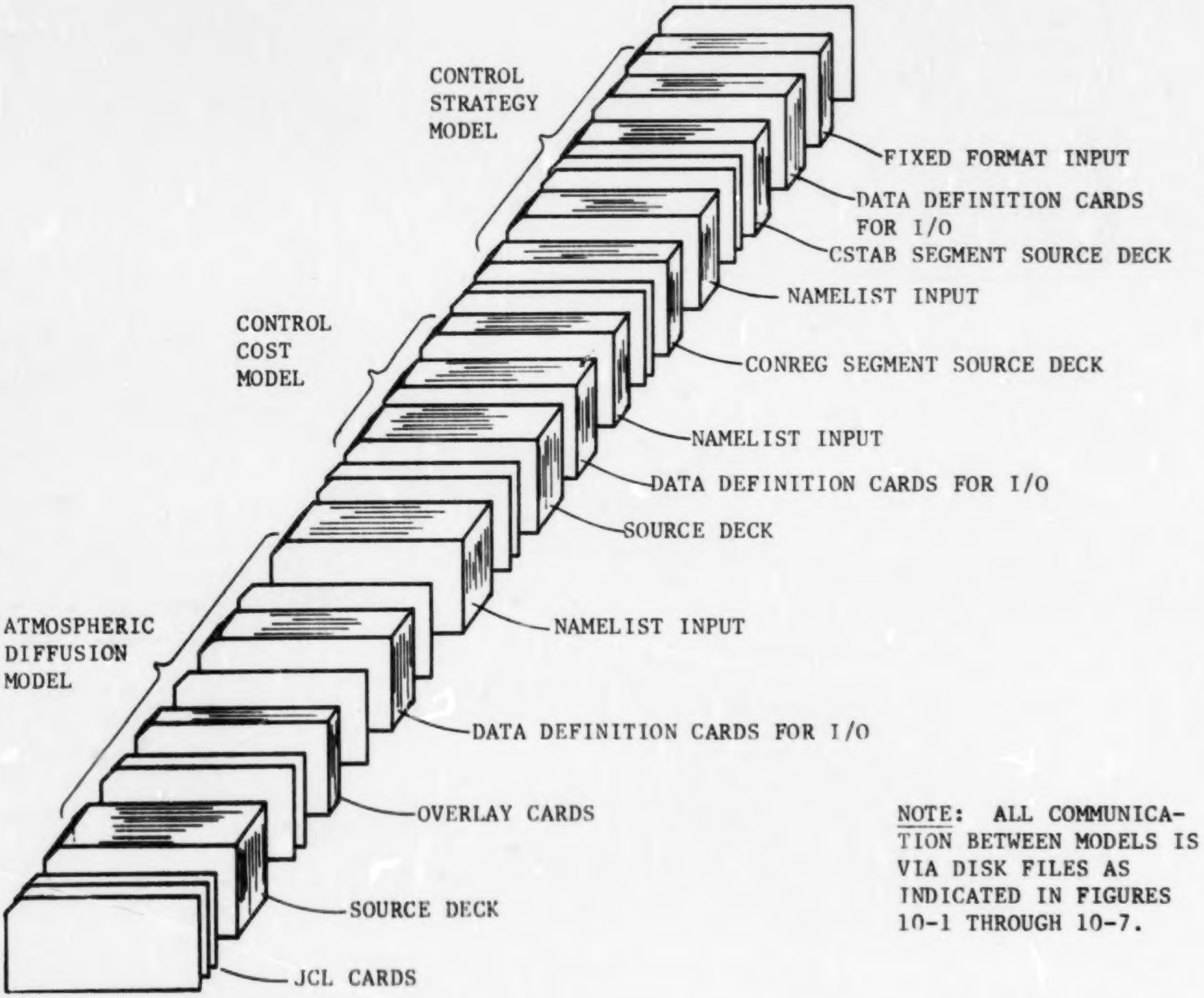

CONTROL
STRATEGY
MODEL
FIXED FORMAT INPUT
DATA DEFINITION CARDS FOR I/O
CSTAB SEGMENT SOURCE DECK
NAMELIST INPUT
CONTROL
COST
MODEL
CONREG SEGMENT SOURCE DECK
NAMELIST INPUT
DATA DEFINITION CARDS FOR I/O
SOURCE DECK
ATMOSPHERIC
DIFFUSION
MODEL
NAMELIST INPUT
DATA DEFINITION CARDS FOR I/O
OVERLAY CARDS
SOURCE DECK
JCL CARDS
NOTE: ALL COMMUNICATION BETWEEN MODELS IS VIA DISK FILES AS INDICATED IN FIGURES 10-1 THROUGH 10-7.

Figure 10-8. Test Setup - Implementation Planning Program

10.4 EXECUTION TIME

The execution time estimates given below for each of the Implementation Planning Program job steps are stated in terms of central processor time on an IBM 360/40.

Creation of the Data File by the Information System takes place in several short steps; a typical file takes approximately 5 minutes to create.

The Atmospheric Diffusion Model job step takes 3.5 hours to process 200 sources and output pollutant concentrations for 225 receptors.

The Control Cost Model job step requires 20 minutes for 165 sources and 50 devices. Running time for this model is directly proportional to the number of point sources.

The Control Strategy Model Emission Standards (CONREG) segment requires 15 minutes to process 165 point sources through 18 emission standards. Running time is directly proportional to the number of point sources and emission standards.

The Control Strategy Model Control Strategy Output (CSTAB) segment takes approximately 35 minutes for a strategy covering 165 sources, 2 political jurisdictions, and 18 potential emission standards.

The core memory requirements for each of the models is listed below:

MODEL	CORE MEMORY (BYTES)
Information System	91,500 (Max)
Atmospheric Diffusion	90,000 - 100,000
Control Cost	100,000 (for 175 sources)
Control Strategy - CONREG	75,000
Control Strategy - CSTAB	58,000

10.5 OUTPUT INFORMATION

The output results generated by the Implementation Planning Program are described in Chapter 9. A sample case (Test City) is constructed in Chapter 8 and used in the preparation of the data file and in the execution of all of the models in the Implementation Planning Program. The program configurations used in the preparation of this output information are the "Test Setup - Information System" (Figure 10-1) and the "Test Setup - Implementation Planning Program" job stream (Figure 10-8).

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APPENDIX A

GLOSSARY OF PROGRAM INPUT VARIABLES

The following names are used to identify namelist input variables used in each of the Implementation Planning Program models. Definitions and input instructions can be found in the following sections:

Section 8.2 - Atmospheric Diffusion Model (ADM)

Section 8.4 - Control Strategies Model (CSM)

Section 8.5 - Strategy Input File Update (SIF)

VARIABLE NAME	MODEL	VARIABLE NAME	MODEL
ACFMN	SIF	IJUR	CSM
AFS	SIF	ILIST	CSM
AQSTAN	ADM, CSM	INCRX	ADM
ASFAC	CSM	INCRY	ADM
BACKGR	ADM	IPL0T	CSM
BLIFE	ADM	IP0LU1	ADM
C0NEF	SIF	IP0LU2	ADM
DATE	ADM	IPR0J	CSM
DELTA	ADM	IPUNCH	ADM
DESER	SIF	IREG	ADM
DESPER	SIF	IREGION	CSM
DEVEFP	SIF	IREGR	SIF
DEVEFS	SIF	ISKIPP	ADM
DPTHMX	ADM	ISKIPT	ADM
EMRATP	SIF	ISTAT	ADM
EMRATS	SIF	ISTATP	ADM, CSM
EXVELN	SIF	ISTATS	ADM, CSM
IADD	ADM	ITIME1	ADM
IAREA	ADM	ITIME2	ADM
IC0NP	ADM	LS0R	SIF
IC0NS	ADM	NPART	ADM
IDATE	CSM	NREG0N	CSM
IDDEV	SIF	NSEL5	ADM
IDUMP	CSM	NSEL12	ADM, CSM

VARIABLE NAME	MODEL	VARIABLE NAME	MODEL
NSØ2	ADM	SLF01	CSM
ØFSCØ	SIF	SMFC01	CSM
PA	ADM	SMIP01	CSM
PARØB	ADM	SMIP02	CSM
PARAVG	ADM, CSM	SØ2AVG	ADM, CSM
PARCAL	ADM	SØ2CAL	ADM
PARPER	CSM	SØ2OB	ADM
PEFC03	CSM	SØ2PER	CSM
PEI01	CSM	STKHTN	SIF
PEIP01	CSM	TA	ADM
PERCNT	ADM	TAB01	CSM
PFAC1	CSM	TAB02	CSM
PFAC2	CSM	TAB03	CSM
PLIP02	CSM	TAB04	CSM
PLSW01	CSM	TAB05	CSM
PLSW02	CSM	TAB06	CSM
PMIP01	CSM	TAB07	CSM
PMIP02	CSM	TAB08	CSM
PMSW01	CSM	TAB09	CSM
PMSW02	CSM	TAB10	CSM
PMSW03	CSM	TAB11	CSM
PØLJUR	SIF	TAB12	CSM
PRCRTM	SIF	TAB13	CSM
PRTYPE	SIF	TAC	SIF
PRUNMF	SIF	TETN	SIF
RATCAP	SIF	UTM	CSM
RBASE	ADM	WNFREQ	ADM
REGIØN	ADM, CSM	XRECEP	ADM
SEFC02	CSM	&CØNIN	CSM
SGDP	ADM, CSM	&INDATA	ADM
SGDS	ADM, CSM	&REGIN	CSM
SHIFTS	SIF	&STRATM	SIF

APPENDIX B

PROGRAM LISTINGS

B-1 INFORMATION SYSTEM
B-2 ATMOSPHERIC DIFFUSION MODEL
B-3 CONTROL COST MODEL
B-4 CONTROL STRATEGIES MODEL

Due to their size, the FORTRAN and COBOL listings of the Implementation Planning Program have been bound under a separate cover. These listings are available from the National Air Pollution Control Administration.

APPENDIX C

REGIONAL AIR POLLUTION CONTROL DIRECTORS, NAPCA

REGION 1 -- Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont

John F. Kennedy Federal Building
Boston, Massachusetts 02203
Phone: 617-223-6883 or 223-6339

REGION 2 -- Delaware, New Jersey, New York, Pennsylvania

Federal Office Building
26 Federal Plaza (Foley Square)
New York, New York 10007
Phone: 212-264-2517

REGION 3 -- District of Columbia, Kentucky, Maryland, North Carolina, Virginia, West Virginia, Puerto Rico, Virgin Islands

220 Seventh Street, N.E.
Charlottesville, Virginia 22901
Phone: 703-296-1387

REGION 4 -- Alabama, Florida, Georgia, Mississippi, South Carolina, Tennessee

Room 404
50 Seventh Street, N.E.
Atlanta, Georgia 30323
Phone: 404-526-5787 or 526-5672

REGION 5 -- Illinois, Indiana, Michigan, Ohio, Wisconsin

New Post Office Building, Room 712
433 West Van Buren Street
Chicago, Illinois 60607
Phone: 312-353-5243 or 353-4589

REGION 6 -- Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, South Dakota

601 East 12th Street
Kansas City, Missouri 64106
Phone: 816-374-5333

REGION 7 -- Arkansas, Louisiana, New Mexico, Oklahoma, Texas

Room 1414, 1114 Commerce Street
Dallas, Texas 75202
Phone: 214-749-3989 or 749-3980

REGION 8 -- Colorado, Idaho, Montana, Utah, Wyoming

Federal Office Building
19th and Stout Streets
Denver, Colorado 80202
Phone: 303-297-4682

REGION 9 -- Alaska, Arizona, California, Hawaii, Nevada, Oregon, Washington, Guam, American Samoa

Federal Office Building
50 Fulton Street
San Francisco, California 94102
Phone: 415-556-4811 or 556-5079

APPENDIX D

FEDERAL LEGISLATION

1. BACKGROUND

1955

The U. S. Congress first responded to growing public concern over declining air quality in July 1955, with legislation authorizing a Federal program of air pollution research and technical assistance to State and local governments (PL 84-159). This legislation established a policy, retained in all subsequent legislation, that State and local governments have fundamental responsibility for local air pollution control with the Federal Government providing leadership and support.

1959

In 1959, Congress amended PL 84-159, declaring that Federal departments and agencies should cooperate with the Department of Health, Education and Welfare and with interstate, State, and local air pollution control agencies in the control of pollutants contributed to the atmosphere of a given region from facilities under Federal jurisdiction.

1961

The first congressional efforts to bring motor-vehicle emissions under control resulted in PL 86-493. This legislation authorized the Public Health Service to conduct a study of pollution caused by motor vehicles and to report the results to Congress. An amendment to this statute (PL 87-761), passed in 1961, authorized motor-vehicle pollution studies on a continuing basis.

1963

As a result of this early legislation, significant progress was made toward achieving an understanding of the air pollution problem and developing methods for air pollution control. By 1963, however, it became obvious that this progress in scientific understanding was not being translated into improved air quality, primarily because State and local governments had neither the resources nor the authority to adequately cope with the problem.

To accelerate air pollution control activities, Congress passed the "Clean Air Act" of 1963 (PL 88-206). This legislation dramatically altered the thrust of the Federal approach to air pollution control. The Act authorized two major new programs: the awarding of grants directly to State and local agencies to assist them in developing, establishing, or improving control programs; and the initiation of Federal abatement actions to cope with interstate and, in some cases, intrastate pollution problems. In addition, it demanded accelerated research, training, and technical assistance activities, and called for the development of criteria on the effects of air pollution on health and property.

As a result of the Clean Air Act, State and local control programs underwent considerable expansion. Federal control actions were initiated, resulting in cleaner air for many communities, and research efforts were expanded.

1965

Various studies had indicated that motor vehicles were contributing significantly to overall air pollution levels, and in 1965 Congress passed an amendment to the Clean Air Act authorizing the Department of Health, Education and Welfare to set emission standards for motor vehicles.

1966

In 1966, another amendment to the Clean Air Act (PL 89-675) authorized grants to State and local air pollution control agencies to assist them in maintaining their programs. These grants supplemented the previously authorized assistance for establishing, developing, and improving programs.

1967

In spite of all of this legislation, the magnitude of the growing air pollution problem rendered control activities inadequate. This inadequacy led to the adoption of new legislation (PL 90-148) which provides a blueprint for a systematic effort to deal with air pollution problems on a regional basis.

The Clean Air Act as amended calls for coordinated action at all levels of government and among all segments of industry. The system which it develops hinges on the designation of air quality control regions. These regions are to be set up according to meteorological and other technical factors, as well as social and political factors, so that areas which share a common air pollution problem may exercise a coordinated control activity. These regions are designated by the Department of Health, Education and Welfare, which is also responsible for monitoring each region's progress in the development and implementation of air quality standards. Other major provisions of the Act as amended include: expansion of the Federal Government's air pollution research and development activities; continuation of grants to States and communities to assist them in their efforts to control air pollution; continued efforts to control pollution at Federal installations; and investigation of manpower and training needs in the air pollution field.

2. CLEAN AIR ACT AS AMENDED

The Clean Air Act as amended provides for the establishment of an intergovernmental system for the prevention and control of air pollution on a regional basis. To put this system into operation, the Department of Health, Education and Welfare must designate air quality control regions and issue air quality criteria and reports on control techniques. State governments are then expected to establish air quality standards for the air quality control regions and to adopt plans for implementation of these standards. The air quality standards and implementation plans prepared by the states must be submitted to HEW for review [Guidelines, 1969].

Figure D-1 shows the division of responsibilities under the Clean Air Act as amended. In developing the Air Quality Display Model [TRW, 1969] and the Implementation Planning Program described in this report, TRW has been guided by the operational structure specified in this legislation. Particular attention has been directed toward the following key elements:

(a) Air Quality Control Regions. Air Quality Control Regions represent the local, operational level for air pollution control as envisioned in the Clean Air Act as amended. Region boundaries are defined on the basis of an analysis of social and political factors as well as physical air pollution effects, and thus may not coincide with established political or geographic divisions. The borders of a given air quality control region will be established so as to include the principal emitters or sources of pollutants for the area, together with a majority of the

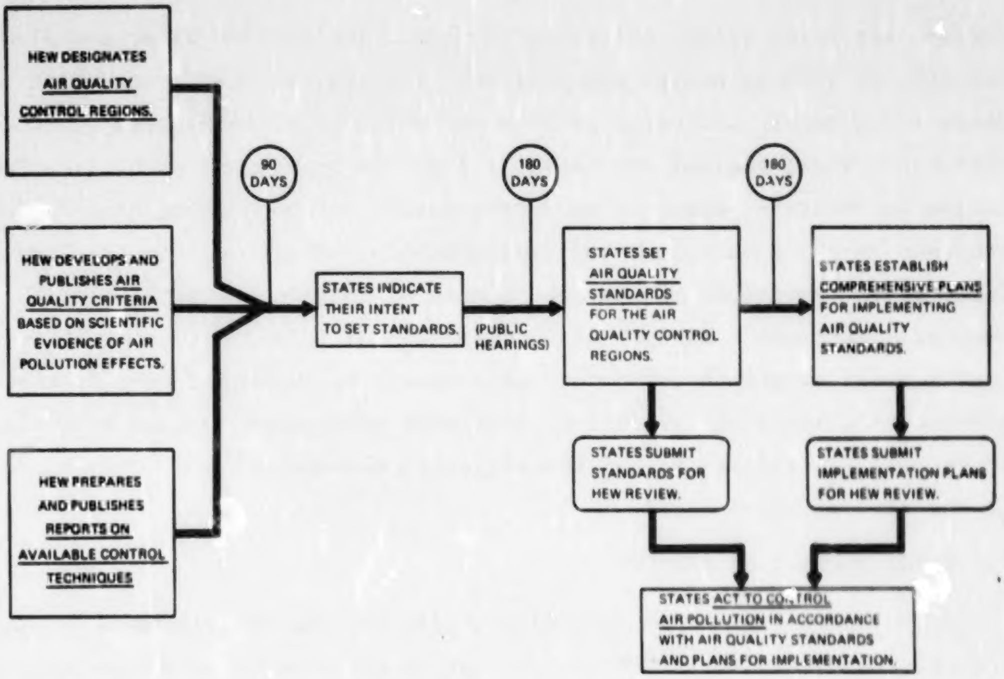
HEW DESIGNATES AIR QUALITY CONTROL REGIONS.
HEW DEVELOPS AND PUBLISHES AIR QUALITY CRITERIA BASED ON SCIENTIFIC EVIDENCE OF AIR POLLUTION EFFECTS.
HEW PREPARES AND PUBLISHES REPORTS ON AVAILABLE CONTROL TECHNIQUES
90 DAYS
STATES INDICATE THEIR INTENT TO SET STANDARDS.
180 DAYS
(PUBLIC HEARINGS)
STATES SET AIR QUALITY STANDARDS FOR THE AIR QUALITY CONTROL REGIONS.
180 DAYS
STATES ESTABLISH COMPREHENSIVE PLANS FOR IMPLEMENTING AIR QUALITY STANDARDS.
STATES SUBMIT STANDARDS FOR HEW REVIEW.
STATES SUBMIT IMPLEMENTATION PLANS FOR HEW REVIEW.
STATES ACT TO CONTROL AIR POLLUTION IN ACCORDANCE WITH AIR QUALITY STANDARDS AND PLANS FOR IMPLEMENTATION.

Figure D-1 Regional Air Pollution Control Under the Clean Air Act as Amended.

receptors (people, plants, animals, and materials) exposed to these pollutants. Major metropolitan areas represent the highest concentrations of both emitters and receptors, although the pattern of receptors affected by pollution will vary according to local meteorological conditions.

In defining the physical or engineering factors of an air quality control region, NAPCA uses input data on pollutant emissions and meteorological factors. An emission inventory is prepared for the given area listing all major sources, types of pollutants, and quantities emitted under various climatological conditions. (Pollutants presently being considered include sulfur oxides, suspended particulate matter, and carbon monoxide.) The input for meteorological factors includes seasonal data on the inversion layer, wind direction, and wind velocity for the area. The statistical distribution of environmental factors and the natural diffusion characteristics of the given pollutants are also considered.

On the basis of all of the above data, average ground-level concentrations of each pollutant during each season are computed, and an output is obtained in the form of a plot of contour lines defining equal pollutant concentrations within the geographic area. The extent of the regional pollution problem may then be readily determined.

Through analysis of these pollutant-concentration plots and their relation to urban and political boundaries, NAPCA defines an air quality control region for the given area. A number of control regions are being established by NAPCA on the basis of these studies, including those for the metropolitan areas listed in the table below.

57 AIR QUALITY CONTROL REGIONS

1. WASHINGTON, D. C.
2. NEW YORK
3. CHICAGO
4. PHILADELPHIA
5. DENVER
6. LOS ANGELES
7. ST. LOUIS
8. BOSTON
9. CINCINNATI
10. SAN FRANCISCO
11. CLEVELAND
12. PITTSBURGH
13. BUFFALO
14. KANSAS CITY
15. DETROIT
16. BALTIMORE
17. HARTFORD
18. INDIANAPOLIS
19. MINNEAPOLIS-ST. PAUL
20. MILWAUKEE
21. PROVIDENCE
22. SEATTLE-TACOMA
23. LOUISVILLE
24. DAYTON
25. PHOENIX
26. HOUSTON
27. DALLAS-FT. WORTH
28. SAN ANTONIO
29. BIRMINGHAM
30. TOLEDO
31. STEUBENVILLE
32. CHATTANOOGA
33. ATLANTA
34. MEMPHIS
35. PORTLAND, OREGON
36. SALT LAKE CITY
37. NEW ORLEANS
38. MIAMI
39. OKLAHOMA CITY
40. OMAHA
41. HONOLULU
42. BEAUMONT-PORT ARTHUR
43. CHARLOTTE, N. C.
44. PORTLAND, MAINE
45. ALBUQUERQUE
46. LAWRENCE-LOWELL-MANCHESTER
47. EL PASO
48. LAS VEGAS
49. FARGO-MOORHEAD
50. BOISE
51. BILLINGS
52. SIOUX FALLS
53. CHEYENNE
54. ANCHORAGE
55. BURLINGTON
56. SAN JUAN
57. VIRGIN ISLANDS

(b) Air Quality Criteria. The Department of Health, Education and Welfare is responsible for developing and issuing air quality criteria. These criteria are to be based on current analyses of the adverse effects of specific air pollutants and combinations of pollutants on man and his environment. Although the evidence in the criteria documents will not necessarily be based precisely on levels of exposure below which there are no adverse effects, they will nonetheless provide quantitative guidance to the States for establishment of regional air quality standards. The documents on sulfur oxide and particulate matter criteria indicate the following:

(1) Under the conditions prevailing in areas where the studies were conducted, adverse health effects were noted when 24-hour average levels of sulfur dioxide exceeded 300 $\mu g/m^3$ (0.11 ppm) for 3 to 4 days. Adverse health effects were also noted when the annual mean level of sulfur dioxide exceeded 115 $\mu g/m^3$ (0.04 ppm). Visibility reduction to about 5 miles was observed at 285 $\mu g/m^3$ (0.10 ppm); adverse effects on materials were observed at an annual mean of 345 $\mu g/m^3$ (0.12 ppm); and adverse effects on vegetation were observed at an annual mean of 85 $\mu g/m^3$ (0.03 ppm). It is reasonable and prudent to conclude that, in the

promulgation of ambient air quality standards, consideration should be given to requirements for margins of safety which would take into account long-term effects on health, vegetation, and materials occurring below the above levels [Air Quality Criteria, SO_x].*

(2) Under the conditions prevailing in areas where the studies where conducted, adverse health effects were noted when the annual mean level of particulate matter exceeded 80 $\mu g/m^3$. Visibility reduction to about 5 miles was observed at 150 $\mu g/m^3$, and adverse effects on materials were observed at an annual mean exceeding 60 $\mu g/m^3$. It is reasonable and prudent to conclude that, in the promulgation of ambient air quality standards, consideration should be given to requirements for margins of safety which would take into account long-term effects on health and materials occurring below the above levels [Air Quality Criteria, Particulates].

(c) Control Techniques. For each of the pollutants covered by a criteria document, the Department of Health, Education and Welfare issues a report on control techniques. These reports provide engineering handbook information on the physical characteristics, operating characteristics, and cost characteristics of control measures. From these documents, control cost-effectiveness information can be obtained for control devices, such as precipitators and fabric filters, or nondevice control measures, such as the use of low-sulfur-content fuels or alterations to basic industrial processes which lessen pollutant emissions [Control, SO_x; Control, Particulates].

(d) Air Quality Standards. Air quality standards, developed on the basis of the air quality criteria, are goals established by the States for the protection of public health and welfare. They provide the States with a basis for controlling existing sources of pollution emissions and preventing future regional growth from adding to the pollution porblem. These goals are stated in the form of desired limits on the level of each particular air pollutant. The goals may reflect more than one air quality standard, specifying both minimum air quality level and higher levels of air quality. The goals must also preclude the possibility of significant deterioration in existing air quality levels.

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*all references are listed in Chapter 11.

(e) Implementation Planning. Implementation plans are blueprints for establishing and maintaining air quality standards. The major elements of a plan include:

- Emission control regulations for each pollutant
- Time schedule for achieving compliance
- Emergency action procedures
- Surveillance and enforcement program
- Definition of required legal authority
- Determination of required resources